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The Engineer.

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The Engineer

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PUBLIC NOTICES

HEATING APPARATUS.

The Commissioners of His Majesty's Works, &c., are prepared to receive TENDERS before 11 a.m. on 7th November, 1928, for the INSTALLATION of HEATING APPARATUS at the Post Office and Telephone Exchange at Hastings.

Drawings, specification, and a copy of the conditions and form of contract, bills of quantities and forms for Tender may be obtained from the CONTRACTS BRANCH, H.M. Office of Works, King Charles-street, London, S.W. 1, on payment of One Guinea. (Cheques payable to the Commissioners, H.M. Office of Works.) The sums so paid will be returned to those persons who send in Tenders in conformity with the conditions. 9851

The Director-General, India Store Department, Belvedere-road, Lambeth, S.E. 1, invites TENDERS for :—
SIGNAL and INTERLOCKING MATERIALS.

Tenders due on the 2nd November, 1928.

Forms of Tender obtainable from the above at a fee (which will not be returned) of 5s. for each schedule. 9866

Assistant Engineers Required by the GOVERNMENT of NIGERIA for the PUBLIC WORKS DEPARTMENT, for two tours of not less than 12 nor more than 18 months' service in the first instance. Subject to satisfactory service, the officers appointed will be eligible at the expiration of three years' service for confirmation in the permanent and pensionable establishment. The foregoing officers are required to fill vacancies caused by the increase of the establishment of the Nigeria Public Works Department. Salary £480 a year for the first three years; then £510, rising by annual increments to £930. Outfit allowance of £60 on first appointment. Free quarters and passages and liberal leave on full salary. Candidates must have attained the age of 21½ years on the date of appointment, and should preferably have attained the age of 22½, and must not be over 35 years of age. Must have obtained an Engineering Degree at a recognised University or have passed Sections "A" and "B" of the A.M.I.C.E. Examination or have passed the Associateship in Civil Engineering of the City and Guilds Institute, or possess such other Degree or Diploma or Distinction in Engineering as may be considered satisfactory. Candidates whose qualifying diplomas have been obtained without a College course should have had three years' practical experience of Civil Engineering under a qualified Civil Engineer. It is preferred that all candidates should have had two years' practical experience on good Engineering Work, subsequent to taking their degree or completing their articles, but under certain conditions this may be waived in the case of candidates in possession of an Engineering Degree.—Apply at once by letter, stating age, qualifications and experience, to the CROWN AGENTS FOR THE COLONIES, 4, Millbank, S.W. 1, quoting M/254. 9732

The High Commissioner for India is prepared to receive APPLICATIONS for the POST of HYDRO-ELECTRICAL ENGINEER, Irrigation Branch, Public Works Department, United Provinces, India.

Candidates must possess a recognised University Engineering Diploma, be corporate members of the Institution of Electrical Engineers, and have had at least three years' workshop experience. They must have had practical experience of the design, construction and control of Reaction Turbine Stations, High-voltage Transformation and Transmission Systems. Other things being equal, preference will be given to a candidate who possesses experience of the working of large hydro-electrical undertakings in the Colonies and elsewhere.

Appointment for five years in the first instance, with prospect of permanency. Pay on age scale, e.g., for an officer of non-Asiatic domicile, age 30, Rs. 1625 a month; 40 years, Rs. 1750, rising to Rs. 2150, plus overseas pay of £13 6s. 8d. a month; for an officer of Asiatic domicile, Rs. 1375 a month, rising to Rs. 2150. First-class passage, Provident Fund.

Further particulars and forms of application may be obtained upon request by postcard to the SECRETARY TO THE HIGH COMMISSIONER FOR INDIA, General Department, 42, Grosvenor-gardens, London, S.W. 1. Last date for receipt of applications 27th October, 1928. 9752

The High Commissioner FOR INDIA is prepared to receive APPLICATIONS for APPOINTMENT as ASSISTANT EXECUTIVE ENGINEER in the Public Works Department, Buildings and Road Branch, Bengal.

The appointment will be on agreement for three years in the first instance, with the prospect of permanent appointment thereafter. Candidates should be not more than 24 years of age and preferably unmarried. They must either (1) have obtained a University Degree in Civil Engineering or (2) have passed Sections A and B of the A.M.I.C.E. Examination or (3) have passed the Associateship in Civil Engineering of the City and Guilds Institute (Imperial College of Science and Technology), or have obtained such other Diploma or Distinction in Engineering as may be considered acceptable in any particular case. In addition they must have had at least one year's practical experience of Civil Engineering under a qualified civil engineer. Those whose qualifying diploma has been obtained without a College course should have had a full three years of such practical experience.

Pay at the rate of Rs. 625 per mensem. Free passage to Calcutta. Provident Fund.

Further particulars and forms of application may be obtained upon request by postcard from the SECRETARY TO THE HIGH COMMISSIONER FOR INDIA, General Department, 42, Grosvenor-gardens, London, S.W. 1. Last date for receipt of applications 27th October, 1928. 9753

University of London. A COURSE of THREE LECTURES on "SMOKE POLLUTION OF THE AIR AND PUBLIC HEALTH," will be given by Dr. JOHN S. OWENS, B.A., A.M.I.C.E., F.R.G.S., at UNIVERSITY COLLEGE, LONDON (Gower-street, W.C. 1), on FRIDAY, NOVEMBER 2nd, FRIDAY, NOVEMBER 9th, and WEDNESDAY, NOVEMBER 14th, at 5.30 p.m. At the first lecture the chair will be taken by Sir Richard Threlfall, G.B.E., F.R.S. (Chairman of the Fuel Research Board in the Department of Scientific and Industrial Research).
ADMISSION FREE, WITHOUT TICKET.
EDWIN DELLER,
9824 Academic Registrar.

PUBLIC NOTICES

University of the Witwatersrand, JOHANNESBURG, SOUTH AFRICA.

JUNIOR LECTURER IN ELECTRICAL ENGINEERING.

APPLICATIONS are INVITED for the above POST.

The salary offered is at the rate of £354 per annum, rising by two annual increments of £27 10s. to a maximum of £409 per annum, of which £300-25-£350 is pensionable. Participation in the Pension Scheme at the rate of 6 per cent. per annum is compulsory, the Government providing the same amount.

A sum of £60 will be allowed towards passage expenses to South Africa, subject to a proportionate refund in the event of resignation from appointment within two years of assumption of duty; half salary paid from the date of embarkation.

The following qualifications are of first importance in connection with the appointment :—

(a) Drawing-office experience in a manufacturing organisation;

(b) Technical training in a University or equivalent training in a Technical Institution.

Applicants are requested to give full particulars of their career, educational and professional, and to supply copies of testimonials and references as to character.

Duty should be assumed on 1st February, 1929, or as soon as possible thereafter.

Applications, in triplicate, must reach the SECRETARY TO THE HIGH COMMISSIONER FOR SOUTH AFRICA, Trafalgar-square, London, W.C. 2 (from whom forms of application and further particulars may be obtained), not later than the 1st November, 1928. 9746

City of Stoke-on Trent.
ELECTRICAL ENGINEER'S DEPARTMENT.
CONTRACT No. 2835.

TENDERS are INVITED for the SUPPLY and ERECTION of a JIB for 3-Ton ELECTRIC WHARF CRANE at the Central Power House, Hanley.

Specification and Tender forms obtainable from the City Electrical Engineer, St. George's Chambers, Kingsway, Stoke-on-Trent, on deposit of £2.

Tenders should be delivered to the undersigned in the envelope provided not later than the first postal delivery on Thursday, 25th October, 1928.
E. B. SHARPLEY,
Town Clerk.
Town Hall, Stoke-on-Trent,
11th October, 1928. 9820

PUBLIC NOTICES

Armstrong College, NEWCASTLE-UPON-TYNE.
(IN THE UNIVERSITY OF DURHAM.)

COURSES for the PASS DEGREE of B.Sc. and the HONOURS DEGREE of B.Sc. in MECHANICAL, MARINE, CIVIL or ELECTRICAL ENGINEERING, MINING, METALLURGY, or NAVAL ARCHITECTURE. The curricula of the Pass Degree and the Honours Degree normally occupy periods of three and four years respectively, but candidates presenting evidence of sufficient previous training may be allowed to proceed to either Degree after two years' residence.

The engineering laboratories have recently been extended, and all Departments are equipped for advanced tutorial and research work.

Full particulars of the Courses may be had on application to

THE REGISTRAR,
Armstrong College,
8025 Newcastle-upon-Tyne.

Bath Union.
TO HEATING, &c., ENGINEERS.
FROME-ROAD HOUSE, BATH.

TENDERS are INVITED for the INSTALLATION of a new BOILER, ALTERATIONS and ADDITIONS to the LAUNDRY, DOMESTIC HOT WATER SERVICES, in the Institution and the HEATING of the Infirmary, in accordance with the plans and specification prepared by the Guardians' Consulting Engineer, Mr. E. S. Hoare, A.M.I.C.E., Bristol.

Sealed and endorsed Tenders must reach the undersigned by 10 a.m. on Monday, the 12th November, 1928.

Copies of the specification may be had on application to the undersigned on payment of a deposit of £3 3s., which will be refunded on receipt of a bona fide Tender.

The Guardians do not bind themselves to accept the lowest or any Tender.
C. J. BUTLIN,
Clerk to the Guardians.
Union Offices,
12, Charlotte-street, Bath,
15th October, 1928. 9829

PUBLIC NOTICES

In the High Court of Justice, Chancery Division, Mr. Justice Maugham. 1928.N. No. 044.
In the Matter of the NORTH-WESTERN ANGLO-SWEDISH ELECTRIC WELDING COMPANY LIMITED AND REDUCED,
and
In the Matter of THE COMPANIES (CONSOLIDATION) ACT, 1908.

Notice is Hereby Given that a PETITION presented to the High Court of Justice Chancery Division on the fifth day of October 1928 for CONFIRMING the REDUCTION of the CAPITAL of the above-named Company from £80,000 to £15,000 by cancelling Capital which has been lost or is unrepresented by available assets is directed to be HEARD before Mr. Justice Maugham on TUESDAY the 30th day of OCTOBER 1928.

Any Creditor desiring to oppose the making of an Order for the Reduction of the Capital of the said Company under the above Act may appear at the time of the hearing by himself or his Counsel for that purpose. Such person is required to give two clear days' notice in writing of his intention to appear with the grounds of his objections to the undersigned the solicitors of the Company.

A copy of the Petition will be furnished to any such person requiring the same by the undersigned on payment of the regulated charge for the same.

Dated the 16th day of October 1928.
NICHOLLS and CO.,
17 Farringdon-street, London, E.C. 4,
9846 Solicitors for the Company.

Administrative County of LONDON.

The London County Council invites TENDERS for the REMOVAL and DISPOSAL of SLOP and REFUSE from, and the SUPPLY and DELIVERY of HOGGIN and SAND to, Blackwall and Rotherhithe Tunnels during the twelve months commencing 20th December, 1928.

The form of Tender may be obtained on application to the Chief Engineer of the Council at the Old County Hall, Spring Gardens, S.W. 1.

The contractor will be bound to observe the provisions of a fair wages clause, the terms of which are set out fully in the instructions for Tender and form of contract and in the "London County Council Gazette."

No Tender received by the Clerk of the Council at The County Hall, Westminster Bridge, S.E. 1, after 4 p.m. on Monday, 29th October, 1928, will be considered.

The Council does not bind itself to accept the lowest or any Tender.
MONTAGU H. COX,
9848 Clerk of the London County Council.

County Borough of Halifax.
GORPLE RESERVOIRS—VALVES, PIPES, IRONWORK, &c.

The Waterworks Committee invite TENDERS for the SUPPLY of VALVES, METERS, RECORDERS and MISCELLANEOUS IRONWORK, required in the construction of the above Reservoirs. Drawings may be seen, and specification, schedule and form of Tender obtained, on application to Messrs. G. H. Hill and Sons (Manchester), 40, Kennedy-street, Manchester, upon receipt of a cheque for Two Guineas, which will be returned to the applicant, provided that he shall have sent in a bona fide Tender, and shall have not withdrawn the same, and shall have returned the documents and drawings lent to him.

A limited number of copies of the drawings are available, and will be lent to persons tendering in priority of application, on receipt of the sum of Two Guineas, which sum will not be returned.

Sealed Tenders, endorsed "Tender for Valves, Pipes, Ironwork, &c., Gorple Reservoirs," must be delivered at the office of the Town Clerk, Town Hall, Halifax, not later than the 19th November, 1928.

The Committee do not bind themselves to accept the lowest or any Tender.
PERCY SAUNDERS,
Town Clerk.
Town Hall, Halifax,
10th October, 1928. 9796

County Borough of Halifax.
GORPLE RESERVOIRS—CAST IRON PIPES AND SPECIAL CASTINGS.

The Waterworks Committee invite TENDERS for the SUPPLY of about 1300 Tons of CAST IRON PIPES and SPECIAL CASTINGS, chiefly 18in. diameter. The drawing may be seen, and specification, schedule, with form of Tender obtained, on application to Messrs. G. H. Hill and Sons (Manchester), Civil Engineers, 40, Kennedy-street, Manchester, upon receipt of a cheque for One Guinea, which will be returned to the applicant provided that he shall have sent in a bona fide Tender, and shall have not withdrawn the same, and shall have returned the documents and drawings lent to him.

A limited number of copies of the drawing are available, and will be lent to persons tendering in priority of application on receipt of the sum of Half-a-Guinea, which sum will not be returned.

Sealed Tenders, endorsed "Tender for Cast Iron Pipes, Gorple Reservoirs," must be delivered at the Office of the Town Clerk, Town Hall, Halifax, not later than the 19th November, 1928.

The Committee do not bind themselves to accept the lowest or any Tender.
PERCY SAUNDERS,
Town Clerk.
Town Hall, Halifax,
10th October, 1928. 9795

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PUBLIC NOTICES

County Borough of Dublin.
NORTH LOTTS DRAINAGE—CONTRACT NO. 4.
PUMPING MACHINERY.

The Commissioners of the County Borough of Dublin invite TENDERS for the SUPPLY and ERECTION OF SIX AUTOMATICALLY CONTROLLED ELECTRICALLY DRIVEN PUMPS, to be erected at three pumping stations and varying in capacity from about 200 to about 1060 gallons per minute, together with PIPE and other WORK connected therewith. The pumps are required to pump unscreened sewage.

Particulars and form of Tender may be obtained at the offices of the City Engineer, Castle-street, Dublin, and at the office of Mr. J. S. Alford, M. Inst. C.E., 11, Victoria-street, Westminster, S.W.1, upon payment of Two Guineas by cheque payable to the Dublin Corporation and crossed "Bank of Ireland." The deposit will be refunded to contractors who send in a bona fide Tender and return all the documents furnished to them.

Tenders, addressed to the Commissioners of the County Borough of Dublin, City Hall, Dublin, and marked on the outside "North Lotts Drainage—Tender for Contract No. 4," should be received not later than Noon on 26th day of November, 1928.

The lowest or any Tender will not necessarily be accepted.

GERALD J. SHERLOCK,
Town Clerk.

City Hall, Dublin,
17th October, 1928. K.A.A. 9863

County Borough of Dublin.
CHAPELIZOD DRAINAGE.

The Commissioners of the County Borough of Dublin invite TENDERS for the following WORKS :—

CONTRACT 1.—About 11 Miles of 9in. and 12in. Cast Iron Sewers, about ¼ Mile of 6in. and 9in. Stoneware Pipe Sewers, 12in. Rising Main under River Liffey, Manholes and Auxiliary Works.

CONTRACT 2.—Two Pumping Stations, each consisting of a Cast Iron Tubbing Chamber with Brick Motor House above, together with Auxiliary Works at each site. No permanent pumping machinery is included in either contract.

The specifications, bills of quantities, and drawings may be seen at the offices of the City Engineer, 28, Castle-street, Dublin, and at the offices of Mr. J. S. Alford, 11, Victoria-street, Westminster, S.W.1, between 10 a.m. and 4 p.m. on any weekday except Saturday. Copies of the specifications, bills of quantities, and drawings of either or both contracts may be obtained by public works contractors at either of the above-named offices upon payment of the sum of Five Pounds by crossed cheque only. The deposit will cover the documents relating to both contracts and will be returned to firms who have sent in a bona fide Tender for either contract and have returned all the documents entrusted to them in connection with both contracts.

Tenders, addressed to "The Commissioners of the County Borough of Dublin, City Hall, Dublin," and marked on the outside "Chapelizod Drainage—Tender for Contract No. ..." should be received not later than Noon on 26th November, 1928.

The lowest or any Tenders will not necessarily be accepted.

GERALD J. SHERLOCK,
City Hall, Dublin. Town Clerk.
17th October, 1928. K.A.A. 9862

Manchester Corporation Water-Works.

The Waterworks Committee invite TENDERS for the SUPPLY, DELIVERY and ERECTION of the following Machinery at their Lostock Booster Station, near Bolton, viz.:—

CONTRACT No. 7.—ONE 400 kW ROTARY CONVERTER, together with Transformer, Switchgear, Cables, &c.

CONTRACT No. 8.—FOUR Electrically Driven CENTRIFUGAL PUMPS, to deliver 3250/4750 gallons per minute against a head of 40/90ft., together with Switchgear, Pipes, Valves, &c.

Complete Tenders only will be considered.

Specifications, &c., for each contract may be obtained on application to the WATERWORKS ENGINEER, Town Hall, Manchester, on payment of the sum of Two Guineas for each copy, which sums will only be returned on receipt of bona fide Tenders and all the drawings and documents lent.

Sealed Tenders, endorsed as directed, must be delivered not later than the 8th November, 1928.

9828

South Indian Railway Company,
LIMITED.

The Directors are prepared to receive TENDERS for the SUPPLY of :—

1. STEEL TYRES for LOCOMOTIVE ENGINES AND TENDERS.
2. FLEXIBLE BUFFERS FOR LOCOMOTIVE ENGINES.
3. SOLID DRAWN STEEL BOILER TUBES.

Specifications and forms of Tender will be available at the Company's Offices, 91, Petty France, Westminster, S.W.1.

Tenders, addressed to the Chairman and Directors of the South Indian Railway Company, Limited, marked :—"Tender for Steel Tyres for Locomotive Engines and Tenders," or as the case may be, with the name of the Firm Tendering, must be left with the undersigned not later than 12 Noon on Friday, the 2nd November, 1928.

The Directors do not bind themselves to accept the lowest or any Tender.

A charge, which will not be returned, will be made of 10s. for each copy of the specification No. 1, and of 2s. 6d. for each copy of specifications Nos. 2 and 3.

Copies of the drawings may be obtained at the Offices of the Company's Consulting Engineers, Messrs. Robert White and Partners, 3, Victoria-street, S.W.1.

A. MUIRHEAD,
Managing Director.

91, Petty France,
17th October, 1928. 9868

State Electricity Commission,
OF VICTORIA, MELBOURNE, AUSTRALIA.

TENDERS are HEREBY INVITED for the MANUFACTURE, SUPPLY and DELIVERY for the Yallourn Brown Coal Works, Victoria, Australia, of ONE (1) ELECTRICALLY OPERATED DEEP DREDGER for BROWN COAL, in accordance with Specification No. 28/94.

Copies of Tender form, specification, &c., will be available upon application to—

The Agent-General for Victoria,
Victoria House,
The Strand,
LONDON, ENGLAND ;

and

Herr J. Klitzing,
Bergwerksdirektor,
Grube Marga,
Bei Senftenberg,
GERMANY.

Tenders on prescribed form, properly endorsed and addressed, must be delivered at the Office of the Agent-General for Victoria, not later than 17th December, 1928, together with a preliminary deposit of £50.

The Commission does not bind itself to accept the lowest or any Tender.

W. J. PRICE,
9789 Acting Secretary.

Truro Port and Harbour.
DREDGER.

The Truro City Council, acting as the Port and Harbour Authority, invite TENDERS for the SUPPLY of a SEA-GOING GRAB HOPPER DREDGER, with a hopper capacity of about 150 tons. Particulars can be obtained from the undersigned, to whom sealed Tenders, endorsed "Dredger," should be delivered not later than Noon on Tuesday, 13th November, 1928.

The Council do not bind themselves to accept the lowest or any Tender.

F. A. BARNES, Assoc. M. Inst. C.E.,
City Engineer and Surveyor.

Municipal Buildings, Truro,
15th October, 1928. 9840

PUBLIC NOTICES

HAULBOWLINE DOCKYARD.

Machinery and Scrap For Sale.

The Commissioners of Public Works invite TENDERS for the PURCHASE of a large quantity of SURPLUS MACHINERY and SCRAP at Haulbowline.

The property to be sold includes :—

A number of Lathes, Milling Machinery and several Machine Tools suitable for motor car or general engineering work.

A complete Laundry Plant.

A large quantity of Iron and Steel Scrap.

Several large removable Buildings.

Permits to view the material and full particulars of it can be had on application to the undersigned.

Tenders for all or part of the material will be received up to 30th November, 1928.

T. CASSEDY,
Secretary.

Office of Public Works, Dublin,
11th October, 1928.
5/A. 403 9830 W.H. Co.

Indian State Railways.

FOUR ASSISTANT ENGINEERS are REQUIRED for service in the Mechanical Engineering Department of the Indian State Railways.

AGE.—Not more than 25 years.

QUALIFICATIONS.—Candidates should have received a good general and technical education and have passed the Associate Membership Examination of the Institution of Civil Engineers, or hold a Degree or Diploma granting exemption from Sections "A" and "B" of this examination ; should have served at least 4 years as pupil or apprentice in the Locomotive Workshops of a British Railway Company or firm of Locomotive Builders of repute, and at least 1 year in the Drawing-office, and possess an intimate knowledge of the Planning, Processing and Costing Methods adopted in workshops of up-to-date commercial firms.

SALARY.—Initial salary, Rupees 375 a month (plus Rs. 150 overseas pay for an officer of non-Asiatic domicile). Salary payable from date of landing in India, subject to rules in force. Leave, provident fund and gratuity in accordance with the rules applicable to officers of the Indian State Railways.

Agreement for 3 years in first instance, but service to be extensible beyond that period with the consent of both parties concerned.

A first-class passage to India will be provided on appointment.

Application must be made by letter only, and all applicants must state their age, whether married or single, and give full particulars (in chronological order) of their education, training and subsequent experience, stating the names of railways or contractors by whom they have been employed, and giving details of the work employed upon, with dates in each case. Details should also be given of any previous experience abroad, together with copy of leaving certificate.

Applications, which should be accompanied by COPIES ONLY of testimonials, must be addressed to the undersigned not later than 2nd November, 1928.

Messrs. RENDEL, PALMER and TRITTON,
12/15, Dartmouth-street,
9831 Westminster, S.W.1.

Municipality of Colombo
CEYLON.
APPOINTMENT OF A FIRST-GRADE ENGINEER.

The Colombo Municipal Council REQUIRE the SERVICES of a FIRST-GRADE ENGINEER, more particularly for Drainage Work.

Applicants must have had at least 10 years' practical engineering experience in the construction and maintenance of Sewers, Pumping Stations and Treatment Works. Some experience of House Installations and House Connection Work would also be desirable. Applicants must also have passed the A.M.I.C.E. qualifying examination or the examination of the Institution of Municipal and County Engineers.

The salary attached to the post is Rs. 12,000 a year, rising by annual increments of Rs. 480 to Rs. 15,000.

The officer appointed must provide himself with and maintain a motor car, for which he will receive an allowance of Rs. 1800 a year.

The selected candidate will be required to enter into an agreement to serve the Council for a period of three years. At the end of the three years, if the officer has carried out his duties to the satisfaction of the Council, he will be appointed to the permanent staff, with leave and pension rights according to the Council's Regulations.

Medical examination as to fitness for service in the East is required.

Free passage to Colombo (second class by mail steamer or first class by non-mail steamer) will be provided for the successful candidate and his family, with half-pay during the voyage.

Application forms and further details can be obtained from the Council's London Agents, Messrs. JOHN POOK and CO., No. 68, Fenchurch-street, London, to whom candidates should forward their applications before Monday, November 19th, 1928.

The Town Hall, Colombo,
13th September, 1928. 9747

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED

WANTED, ASSISTANT MECHANICAL ENGINEER for a large Tin Mine in Malaya. An Engineer from Cornwall or Wales, with a knowledge of Diesel Engines, preferred. Quarters, medical attendance, and passage provided. Age about 30 to 32, preferably unmarried.—Applications should be addressed 9817, The Engineer Office, and should state full particulars of experience and salary required, with copies of testimonials attached. 9817 A

WANTED, London, ENGINEER, 25 to 35. Good education, for project and estimating work. D.O. exper. in structural, plate and boiler work desirable. Excellent prospects.—Address, P5091, The Engineer Office. P5091 A

A LARGE ELECTRIC POWER COMPANY in the North REQUIRE the SERVICES of a first-class MECHANIC for their Repairs Department. Excellent prospects for a young energetic man, with experience in the Overhaul of Steam Turbines and Boilers. Present wages, £3 12s. per 47 hour week.—Address, 9825, The Engineer Office. 9825 A

WANTED for Oilfield in the Tropics, ASSISTANT to CHIEF ENGINEER, age 30-35. Primarily a Mechanical Engineer with Civil and Electrical Engineering experience, with university degree. Preference given to men with experience in oilfield work or in erection of large power plants in mines, factories, &c., and capable of preparing estimates and lay-out drawings. Five-year contract. Free passage out and home. —Full details on application to Z.A. 749, c/o Deacon's Advertising Offices, Fenchurch-avenue, E.C.3. 9850 A

ENGINEER ASSISTANT WANTED for Tea Garden in Northern India. Must be educated at a public school, single, between 21 and 25, and fully qualified mechanical engineer with experience of I.C. Engines and Electricity. Salary Rupees 350 per mensem and first-class passage.—Write, with full particulars, to "E. W." care of J. W. Vickers and Co., Ltd., 24, Austin Friars, E.C. 2. 9833 A

ENGINEER REQUIRED With Oil Works Experience for POST in Tunis ; preference given to man having knowledge of French ; situation has excellent prospects. Write, giving full particulars of past situations and stating salary required.—Address, 9870, The Engineer Office. 9870 A

NON-FERROUS TUBES. — TECHNICAL DIRECTOR REQUIRES an ASSISTANT to specialise on improved methods of service to production depts.—Address application, with full details and salary, 9841, The Engineer Office. 9841 A

REPRESENTATIVE REQUIRED by High-class Ironfounders, specialising in Motor Cylinders, to introduce general lines of repetition work ; must be energetic and with established connection.—Address, P5069, The Engineer Office. P5069 A

SITUATIONS OPEN (continued)

REQUIRED IMMEDIATELY, YOUNG GENTLEMAN, about 30 years of age, to Manage Sawmill in British West Africa ; must have thorough knowledge of Woodworking Machinery and Conversion of timber.—Write only, giving full particulars, age and salary required, to Box "G. 160," Algar's, 58, Gracechurch-street, E.C. 3. P5080 A

WORKS MANAGER.—A Fully Qualified and experienced MANAGER is REQUIRED to Take Control of a modern, well-equipped Engineering Factory in the Midlands, employing 500 workpeople and engaged in high-class speciality products. Applicants must have had sound experience in similar positions, must be able to effectively control labour, be competent to fix piecework prices, and secure maximum output. State age, experience, salary required, and when at liberty.—Address, 9859, The Engineer Office. 9859 A

WANTED—
a DRAUGHTSMAN for Engineers in Enfield district.
Address, P5073, The Engineer Office. P5073 A

WANTED, Experienced DRAUGHTSMAN, Conversant with Gasholder and Structural Work.—State full particulars and salary required to CLAYTON, SON and CO., Ltd., Moor End, Hunslet, Leeds. 9843 A

WANTED for India, ENGINEER DRAUGHTSMAN, age 25-26, unmarried ; shop training and drawing-office experience in structural work essential ; preferably having diploma or engineering degree ; gentlemanly type, suitable for sales work required. Commencing salary Rs. 600 month.—Write, Box 347, Leathwait and Simmons, 34, Throgmorton-street, London, E.C. 2. P5086 A

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WANTED, London, DRAUGHTSMAN, to Detail light structural and plate work. General Boiler knowledge desirable. Good prospects.—Address, P5090, The Engineer Office. P5090 A

WANTED, SENIOR MACHINE TOOL DRAUGHTSMAN, one with experience in Boring and Milling Machines preferred.—Address, 9842, The Engineer Office. 9842 A

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DESIGNER and CHIEF DRAUGHTSMAN REQUIRED to Take Charge of Drawing-office in work manufacturing accurate machinery ; must have had considerable Machine Shop Experience.—Address, stating age, experience, and salary required, 9861, The Engineer Office. 9861 A

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DRAUGHTSMEN REQUIRED by London Manufacturers of Heating and Ventilating Plant. Preference given to men capable of preparing schemes for Plenum Heating and General Ventilation.—Write, with full particulars, to Box 71, c/o Mather and Crowther, Ltd., 10/13, New Bridge-street, E.C. 4. 9832 A

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ENGINEER (29) SEEKS APP. Public School education, exp. D.O., and assist. eng. in works erection and maintenance.—BM/L024, London, W.C.1. 9718 B

ENGINEER, Thorough Practical Knowledge, Layouts, purchase, erection, and maintenance of Machinery for Preserve, Chocolate and Confectionery Trades, engagement just closed nine years as Chief Engineer, SEEKS SIMILAR POSITION.—Address, P5089, The Engineer Office. P5089 B

GENTLEMAN of Good Education and Appearance, with specialised knowledge of publicity, is DESIROUS of MAKING a CHANGE where his knowledge and ability can be used to advantage. Engineering publicity preferred. Highest references.—Address, P5085, The Engineer Office. P5085 B

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MECHANICAL ENGINEER (29), Public School, thorough knowledge works management and commercial sides, DESIRES POST in works, commercial or with consulting engineers. Responsible positions held, home and abroad. London area preferred. —Write, Box W. 967, Willing's, 86, Strand, W.C.2. 9687 B

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For continuation of Small Advertisements see page 4.

A Seven-Day Journal

Family Allowances in Belgium.

To-morrow a law of considerable social and industrial significance will come into force in Belgium. After that date it will be necessary for every firm or employer who contracts to do work for, or to supply material to, the State or any public body or institution to be affiliated to a "*caisse de compensation*" and to pay family allowances to all eligible employees. The family allowance, which is additional to ordinary wages, is payable monthly at the rate of 15f. for the first child, 20f. for the second, 40f. for the third, and 80f. each for the fourth and subsequent children. In general the allowances are only paid in respect of children under fourteen years of age, though they will be continued up to the age of eighteen years in the case of boys or girls still at school or working as apprentices. Family allowances are by no means a new thing either in France or Belgium, many industries having schemes of their own, which, however, have been heretofore entirely voluntary on the part of the firms taking part in them. These schemes were always worked by means of "*caisses de compensation*," which spread the burden of the allowances fairly among all the affiliated firms and thus prevented men with large families from being handicapped in obtaining employment. The principle of wage allowances in respect of children has commanded the general assent of all parties, and the new law, which will have the effect of rendering the system practically universal in Belgium, is welcomed as a legal recognition of the fact that a "living wage" depends upon the number of mouths that have to be fed with it. Industry could not have borne a uniform wage level equal to the needs of the men with the largest families, and the theory of the "average working-class family," which is so simple for the statisticians," involves inequalities and hardships that the system of family allowances is designed in some measure to mitigate.

The Flight of the Zeppelin LZ 127.

Shortly before eight o'clock in the morning of Thursday of last week, October 11th, the German airship "Graf Zeppelin," left Friedrichshafen for America, carrying twenty passengers and a crew of forty, together with luggage and about 76 lb. of mail. Passing over Switzerland, France and Spain, she was above Gibraltar at 5 a.m. on Friday, October 12th. At 10 p.m. on that day she was 250 miles south of the Azores, and at midnight on Saturday she passed Bermuda. On the following day, Sunday, she encountered heavy head winds, and seems to have made very little progress. On Monday the winds continued in the morning, and it was not until 3 p.m. on that day that she crossed the United States coast at Cape Henry. Thereafter she sailed over Washington, Baltimore, Wilmington, Philadelphia, and New York, and, finally, at 10.35 p.m., landed at the naval air station at Lakehurst, where she was safely housed in a shed side by side with the airship "Los Angeles," formerly the "L Z 126," which crossed the Atlantic in October, 1924. The total flying time was 4 days 14 h. 45 min., and the average ground speed is estimated at about 55 miles an hour. A slight mishap occurred to one of the tail fins, but it was temporarily repaired in the air. During the voyage the vessel was under the command of Dr. Echener, who also commanded the "L Z 126" in 1924. It is understood that the airship was driven by fuel gas throughout the trip. It may be recalled that the flight of the "L Z 126" was made by way of the same route as far as the Azores, but that thereafter the vessel made for Lakehurst by way of Nova Scotia. That voyage occupied 3 days 9½ h., and was accomplished at an average speed of about 61 miles an hour. The considerably longer time occupied by the "L Z 127" on the crossing is sufficiently accounted for by the longer southernly route followed, by delays caused by the mishap, and by the adverse winds encountered off Bermuda. Some details of the construction of the vessel were given in our issue of October 5th.

Metropolitan Gas Supplies.

While much attention has recently been directed towards the disadvantages arising from a diversity of voltage, &c., in public electricity supplies, little or no consideration has been paid to the lack of uniformity in public gas supplies. Such lack of uniformity in the case of gas supplies is much less important than in the case of electricity supplies, for all gas-consuming apparatus can work with little change of efficiency over a fairly wide range of pressure and calorific value. In the metropolitan area the various gas companies are alike in being required by statute to supply gas at not less than 2in. of water pressure, but they are not alike as regards the calorific value which they are required to maintain. The Wandsworth Company is required to supply gas at an average calorific value of 470 B.Th.U. gross per cubic foot. The Commercial, Gas Light and Coke, South Suburban, and Tottenham companies are required to supply gas at an average of 500 B.Th.U. The South Metropolitan Company is required to give a supply at an average of 560 B.Th.U. During the quarter ended September 30th, according to the Gas Referees' reports, the companies, in the order named, supplied gas having average calorific values of 472·5, 504·7, 503·0, 503·4, 502·6, and 562·4 B.Th.U. per cubic foot. The practice of charging for the gas by the therm instead of by the cubic foot would appear to eliminate any unfairness in the relative charges in the areas served by the companies. It is, however, in practice, fairly certain that an average gas consumer removing, say, from the Wandsworth to the South Metropolitan area would fail to realise that less gas than formerly was required for a given heating effect, or would fail to effect the necessary change of habit in the setting of the taps, and would, as a consequence, find the quarter's bill higher than before.

Standard Marine Oil Engines.

In the course of a paper on "Marine Oil Engines," which he read before the Diesel Engine Users Association on Friday of last week, October 12th, Mr. Sterry B. Freeman introduced the subject of standardised marine oil engines. The ship-owning world at the present moment was, he said, in need of an efficient standard engine, which could be cheaply manufactured by any competent builder on mass production lines. Many makers of oil engines, he continued, already had a standard engine of their own, but what the shipowner wanted was an engine of accepted design covering a large range of power, for which competitive prices could be obtained, the builders relying, as in the days of the conventional triple-expansion inverted reciprocating steam engine, upon the soundness of their differing administrative and executive resources to obtain the contracts they desired. While it is probably correct that the ship-owning world would obtain some benefit from the standardisation of marine oil engines, as suggested by Mr. Freeman, it seems obvious that such standardisation in the present state of development might be premature to an extent that would severely restrict developments in the future. We have only to reflect that opinion is not yet fixed as regards the merits of two-stroke or four-stroke engines, and double or single action, to realise the cramping effects which might possibly flow from an attempt to introduce standardisation before its time.

St. Paul's Bridge.

On Friday of last week, October 12th, a Court of Common Council was held at Guildhall to consider the report of the Bridge House Estates Committee recommending the construction of the proposed St. Paul's Bridge with an eastwards deviation of the northern approach. From the remarks made by the Chairman of the Bridge House Estates Committee it is evident that that Committee advanced the deviation scheme entirely to meet the fears expressed by those concerned about the safety of St. Paul's Cathedral, that it did not share those fears and that it had itself no great liking for the deviation from the original plans. Others were of the same opinion and urged that the Council should reject the deviation scheme and return to the original. Others, however, strongly opposed both the original and the deviation schemes, characterised the bridge as unwanted and argued that the expenditure on its construction—estimated at more than five million pounds—would bring no benefit to the City's inhabitants and ratepayers. On a vote being taken the Council rejected the Committee's report by 85 votes to 69. While this action on the Council's part will probably prove decisive so far as the construction of the bridge with a deviated northern approach is concerned, it is by no means certain that it also implies that the last has been heard of the construction of St. Paul's Bridge in some form or another. The Bridge House Estates Committee has already expended over one million pounds on the acquisition of property on the site required for the bridge and complete plans have been drawn up for its construction. The Council's vote, we take it, does not mean that the whole subject is now to be regarded as closed, but only that the northern deviation scheme has been rejected. Even already efforts are being made to revive the scheme, and in many quarters opinion is as strong as ever concerning the necessity for providing a new north-and-south passageway into, out of, and across the City.

The Singapore Floating Dock.

On October 13th the first portion of the floating dock for the new Admiralty naval base at Singapore arrived safely at its destination after a journey of 8500 miles, lasting nearly four months. The second portion arrived on October 16th. The complete dock will have a lifting capacity of 50,000 tons and is built in seven sections. For the purpose of the voyage from Messrs. Swan Hunter's Wallsend yard to Singapore the dock was divided into two portions, of which the first consisted of the three middle sections and the second of the two sections at each end of the finished dock. The first portion contains the electrical machinery and repair workshops. During the next few weeks the second portion will be divided and the two sections added on to the ends of the first portion. This work will be conducted by local labour and by expert shipyard workers sent out from England. The finished dock will have a length of 855ft., a breadth of 172ft., and a depth overall of 75ft. It will require for its operation a depth of water of about 70ft. Its pumping plant is capable of expelling 30,000 tons of water per hour. The difficult and delicate task of towing the two portions of the dock to Singapore was entrusted to L. Smit and Co., towage contractors, of Rotterdam, a firm possessing wide experience of lengthy ocean towage work. The manner in which the portions were brought through the Suez Canal with very little room to spare reflects great credit on Messrs. Smit and the Canal authorities.

Charing Cross Bridge.

The Government and the London County Council having approved the scheme for the transference of Charing Cross Station to the southern side of the river and the building of a road bridge on the site of the existing railway bridge, everything seems ready for putting the scheme into effect except that so far the Southern Railway has not expressed its willingness to abandon the ground which it has occupied for over sixty years and the bridge whereby it obtains access to it. Negotiations are, however, being conducted between the company and the Ministry of Transport, and although slow progress is apparently being made, it is no slower, it is held, than the magnitude of the scheme justifies and is not such as to lead to the suggestion that a deadlock has arisen. The company, it seems, is seeking guarantees on four points, and until these guarantees are secured the company will not submit the proposals to its shareholders for their approval. What points the company desires to receive guarantees on have not been disclosed, but it is fairly certain that they include the covering of the complete cost of removing the station to its new site and indemnification against any loss of traffic or trade which the removal may throw on the company. The first step in the practical realisation of the scheme would be the construction of the new station, for until it was ready the existing station and the bridge serving it would have to remain at the company's service.

The Charfield Railway Disaster.

On Saturday morning, at Charfield, on the Bristol and Gloucester section of the former Midland Railway, a down goods train was being shunted into the down refuge siding in order to allow the Leeds to Bristol mail train to pass, when the latter train came into collision with the shunting train. The engine of the passenger train was derailed to the right and collided with a passing up goods train. The scene of the accident was under an over-bridge, which fact aggravated the effects of the collision. Unfortunately, fire broke out in the wreckage, which prevented some of the passengers in the damaged coaches escaping. When the fire was subdued, the bodies were found to have been so badly disfigured as to make identification most difficult. It is, however, known that the leading guard of the express was killed, and that thirteen passengers also lost their lives. Colonel Sir John Pringle at the time we go to press is investigating the circumstances of the disaster.

Quick Winding.

We spent a most interesting day last week in Yorkshire in connection with a meeting of the Institution of Mining and Electrical Engineers. It was at the invitation of the Denaby and Cadeby Main Collieries, Ltd., that a party congregated to study the new powdered coal plant, supplied by the General Electric Company, Ltd., connected with three of the large water-tube boilers at the pithead, near Doncaster. Of this installation, however, we cannot speak at length just now; but there were many other things of interest which were revealed during the visit. For one thing, there was the fact that washery waste so full of moisture that it would cake up into a hard mass under the pressure of the hand provides a useful fuel in hand-fired boilers. Another was that the "decking" operation at the heapstead only occupies 17 seconds. During that interval of time the cage is dropped on to the "keeps," the gates are opened, and eight full "tubs" are pushed off the four decks, and are replaced by eight empty tubs. The gates are then closed, and the cage again lifted off the keeps for its next journey down the pit. The performance is indicative of the policy of the colliery owners which has led to the adoption of powdered coal as a fuel and the consequent economy of their resources.

Television.

It is announced by the British Broadcasting Corporation that in agreement with the Post Office it required a studio demonstration of the Baird television apparatus before considering whether there should be public experiments in which one of the Corporation's stations could participate. A demonstration attended by officials of the B.B.C. was given on October 9th at the offices of the Baird Television Development Company, Ltd. The Corporation's representatives formed the opinion that while the demonstration was interesting as an experiment, it failed to fulfil the conditions which would justify trial through a B.B.C. station. For the present, therefore, an experimental transmission through one of the Corporation's stations will not take place, but the Corporation states that it is ready to review this decision if and when development justifies it.

The No. 3 Lister Drive Power Station.

No. I.

The supply of electricity in the City of Liverpool and certain neighbouring parts is derived from three inland generating stations, all situated at Lister Drive. Two of them have been in operation for a considerable time, but the third—a large and thoroughly modern station—was officially opened as recently as July, 1926. Within a period of a few years, the load on the Liverpool plant has increased very rapidly. In 1920 the output was 102,572,526 kilowatt-hours, whilst during the twelve months ending March, 1928, it reached nearly 268 million kilowatt-hours. During the same period the maximum load—see Fig. 1—rose from 38,317 kilowatts to 89,600 kilowatts. This increase in business, it should be explained, was mainly attributable to the increased demand in Liverpool, where, as the result of extensive propaganda, there has been considerable developments in the domestic supply, but it has also been partly attributable to the fact that the Corporation absorbed the electricity supply of some of the neighbouring authorities. Partly on account of the high cost of land, and partly because of tidal difficulties, it was found that it would be more economical to carry out extensions on the original Lister Drive site than to build a new station on the river Mersey. The high tide and extreme low tide conditions in that river differ by approximately 33ft., and the estimated cost of civil engineering proved to be very high; in fact, an expenditure of nearly £400,000 would have been entailed before any part of the station proper could have been begun. The station would either have had to be placed some distance out in the river, or two culverts 12ft. in diameter and 600ft. long would have been necessary, and in all probability unforeseen difficulties would have occurred; therefore, decided to erect the "No. 3 Station," which we now propose to describe, adjacent to the two older stations—as shown in the plan, Fig. 3.

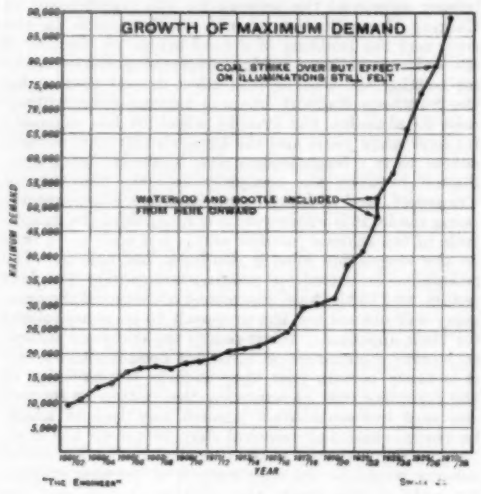

GROWTH OF MAXIMUM DEMAND
COAL STRIKE OVER BUT EFFECT ON ILLUMINATIONS STILL FELT
WATERLOO AND BOOTLE INCLUDED FROM HERE ONWARD
MAXIMUM DEMAND
YEAR
"THE ENGINEER"

FIG. 1—LOAD CURVE

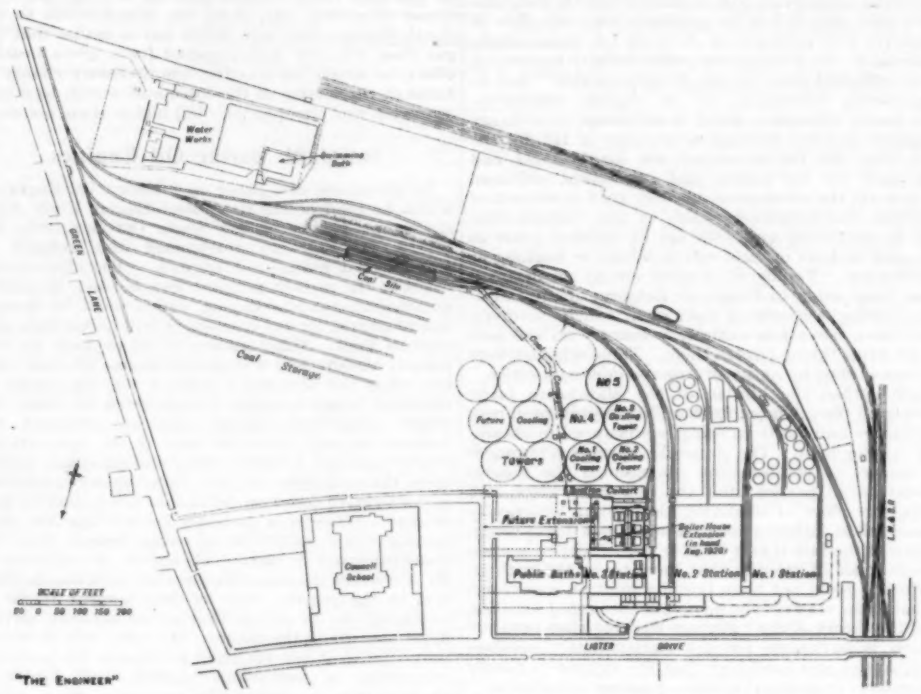


FIG. 3—PLAN OF SITE OF LISTER DRIVE POWER STATIONS

The turbine-house contains two 25,000-kilowatt Metropolitan-Vickers turbo-generating sets, designed for a speed of 1500 revolutions per minute, and for very moderate steam conditions, viz., 275 lb. per square inch gauge at the stop valves, a total temperature of 675 deg. Fah., and 27½in. vacuum. Although a higher pressure would have given greater thermal efficiency, the only site available at the time being situated in close proximity to huge sand banks, and not in the regularly dredged portion of the river Mersey. The amount of sand present in the water in this position would in all probability have led to considerable erosion in the condenser tubes and ferrules. When everything had been taken into account, it was, it was considered at the time that the additional capital cost and cost of repairs would have more than outweighed that advantage. All the plant has, however, been constructed so that the pressure can be raised to 325 lb. per square inch if that pressure should prove desirable. The generating sets are placed across the turbine-room—as shown in Fig. 2—with the turbine adjacent to the boiler-house and the alternator adjacent to the switch-house, an arrangement which involves a minimum amount of steam piping and relatively short conductors on the electrical side. The turbine-room—see the plan of station, Fig. 4—was one of the first to be designed without a continuous floor at the level of the turbines, and with all the auxiliaries in the basement exposed, so that they can be overhauled with a minimum amount of trouble. Ample space is also available with this arrangement for condenser and auxiliary parts when repair and overhaul work is in hand. At one end of the turbine-room there are a loading bay and a workshop connected with a railway siding, while an overhead crane with 15 and 100-ton hoists traverses the whole length of the building.

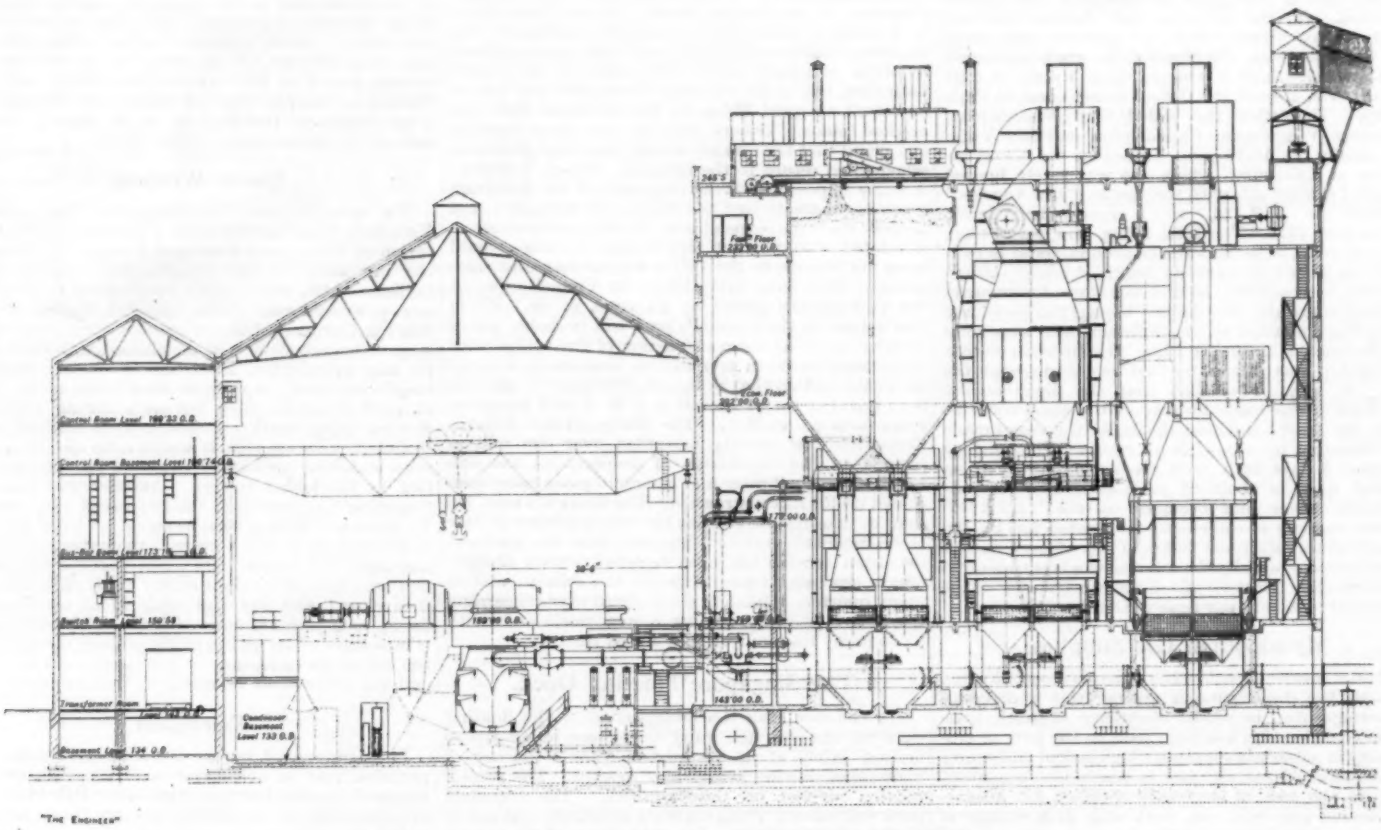


FIG. 2—SECTIONAL ELEVATION OF ENGINE-ROOM AND BOILER-HOUSE

Coal is delivered to the station by rail and is stored

CORPORATION OF LIVERPOOL ELECTRICITY SUPPLY

MR. P. J. ROBINSON, M.I.E.E., LIVERPOOL, ENGINEER

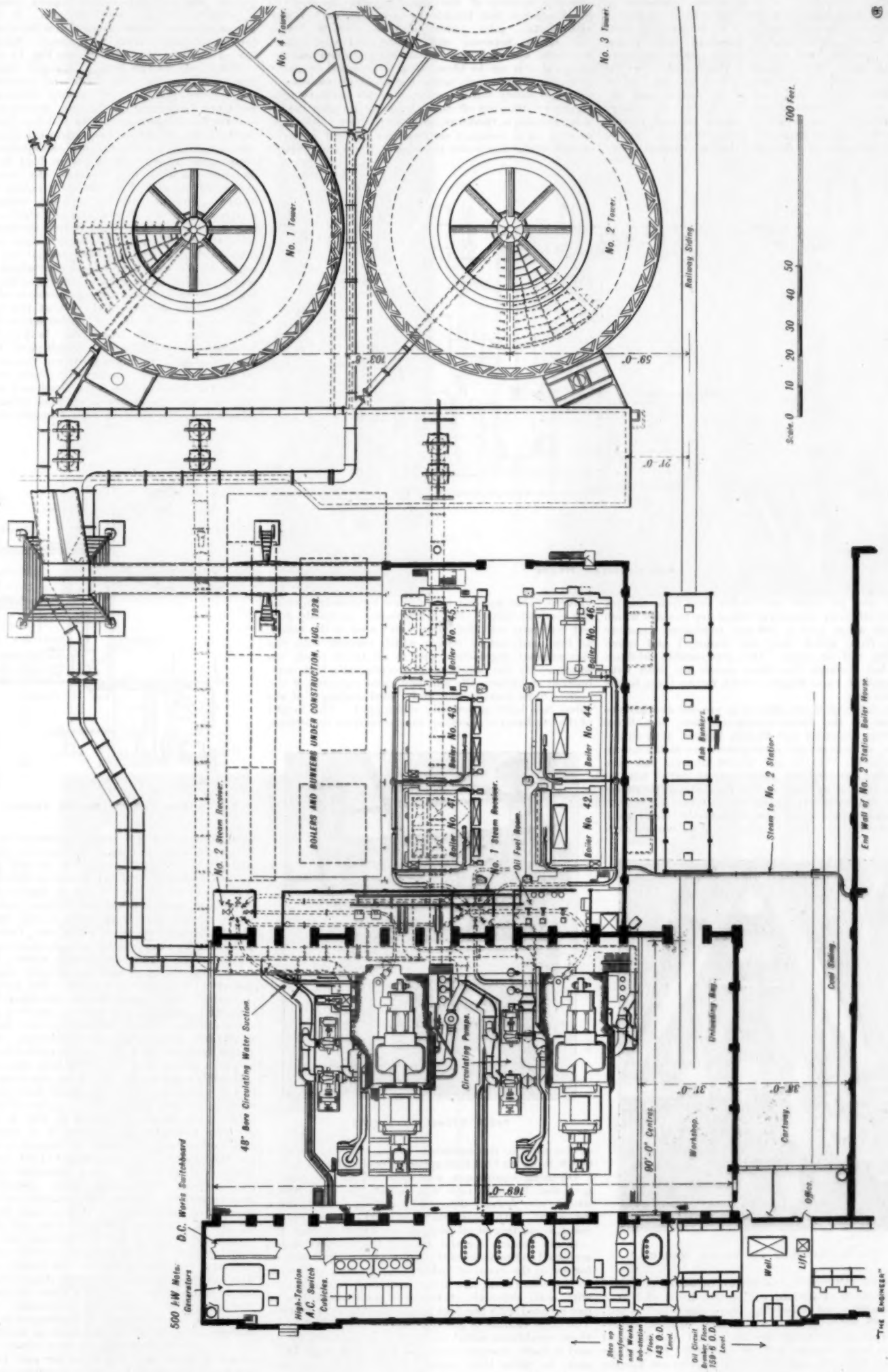


FIG. 4—PLAN OF NO. 3 LISTER DRIVE POWER STATION

"THE ENGINEER"

on the site between parallel rail lines, and is stocked and reclaimed by travelling steam cranes with Priestman grabs. The coal for this No. 3 station, either direct from the colliery or from stock, is handled in hopper bottom wagons which run over a reinforced concrete silo, 225ft. long, with a capacity of 1000 tons. Two parallel rubber conveyor belts under the silo receive the coal through doors operated by rack and pinion gear. These belts, which have a capacity of 300 tons per hour, feed other belts that convey the coal up an incline and discharge it into 1500-ton reinforced concrete boiler-house bunkers from which it passes through chutes to the mechanical stokers. Ashes from the boilers now in operation are dumped through double doors

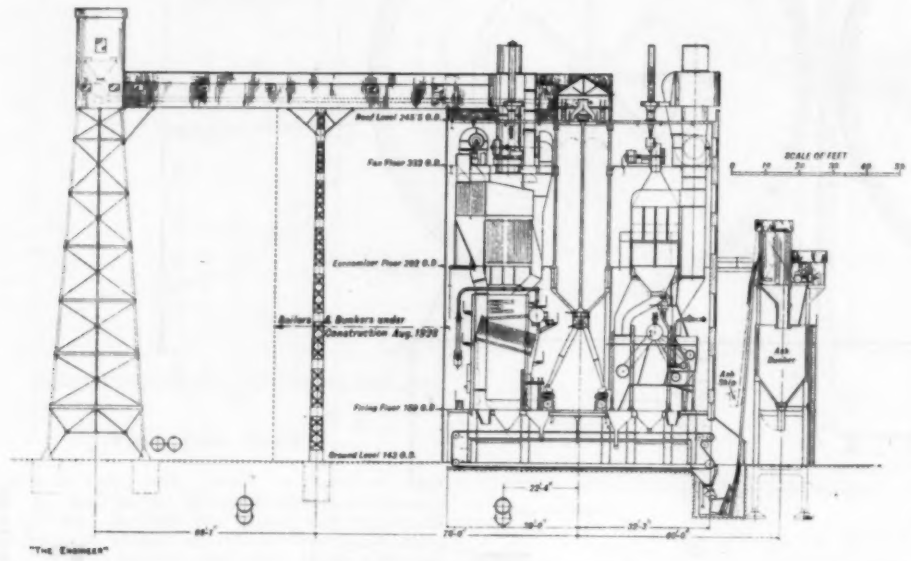


FIG. 5—BOILER-HOUSE

into an open pit under each boiler, and from this pit they are taken by scrapers working dry to skips which raise the ashes into a 300-ton reinforced concrete bunker, from which they are removed and taken away by rail or road. The combustible riddlings which fall through the chain grates are dealt with by means of hand wagons which return them to the coal conveyor.

Only sufficient boiler plant is at present available to run one of the turbo-generating sets, but three 125,000 lb. Babcock and Wilcox boilers, with superheaters, air heaters and economisers are in the course of erection. The second 25,000-kilowatt set was originally intended to serve as a spare, but on account of the increase in the load it will be necessary to run both sets during the forthcoming winter. The steam-raising plant now in operation—see Figs. 5 and 6 and the plan Fig. 4—consists of six boilers, each

FIG. 6—INTERIOR OF BOILER-HOUSE

capable of evaporating 60,000 lb. of water per hour at a pressure of 300 lb. per square inch, and at a total temperature of 700 deg. Fah. Each unit is self-contained with its own mechanical stokers, superheater, economiser, air heater, forced and induced draught fans, chimney and grit collector. Four of the units are Babcock and Wilcox, while two are Yarrow boilers. One of the latter is fitted with the Underfeed Stoker Company's travelling grate stokers; the remaining five boilers are equipped with Babcock and Wilcox chain grate compartment type stokers. In view of the trouble which was known to have been experienced in other stations with safety valves, owing to the rush of the steam causing considerable scoring of the seats, it was decided to guard against this trouble by providing each boiler with a 2in. pilot valve, and a shut-off valve was fitted between this valve and the boiler. Normally, however, the shut-off valve is open and the pilot valve is set to blow off at a pressure of about 10 lb. per square inch below the blow-off pressure of the main safety valves, so that under ordinary conditions the blowing off takes place at the pilot valves only. Scoring is, therefore, confined to those valves, and as soon as it becomes serious, the shut-off valve is closed, whilst the boiler remains at work and a spare valve is fitted and put into service by merely opening the shut-off valve. The arrangement obviously does not interfere with the safety valve area of the boiler, as the main safety valves which comply with the Government regulations are at all times ready for service. By the provision of exceptionally high combustion chambers, the efficiency and capacity of the boilers have been raised, and "bird nesting" of the tubes has been practically eliminated. The height of the combustion chambers measured from the surface

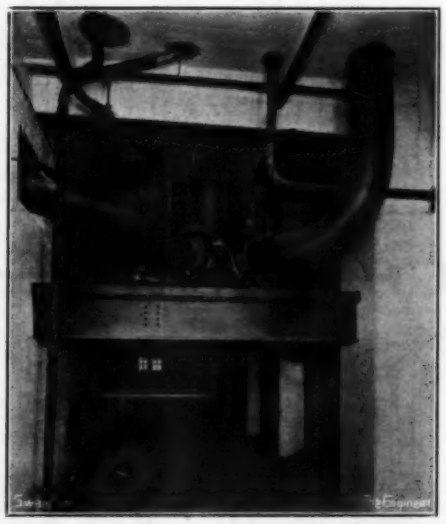


FIG 7—STEAM RECEIVERS

of the grate to the underside of the tubes in the case of the Babcock boilers is approximately 14ft.

Oil-firing equipment was installed at the outset, and was brought into use during the coal strike, when no fewer than 37 million units were generated with this class of fuel. The equipment, consisting of oil pumps—see Fig. 9 on page 425—steam heaters for the oil and the burners which are fitted to the backs of the boilers, have been retained for use in the event of further emergencies, but owing to the cost of oil, the boilers are now normally fired with coal, although, at times of peak loads, the oil can be used with the coal to increase the evaporation. The large volume of gas that has to be handled under these conditions called for very large capacity forced and induced draught fans—see Fig. 10 on page 425—and, in order that under normal conditions they need not run inefficiently at full speed with the fan discharge throttled down, the induction motors which drive them are of the three-speed pole-changing type. Soot blowers are fitted to all the boilers; the air heaters and economisers are also similarly equipped, but the economisers of the Yarrow boilers are fitted with scraper gear. From the economisers and air heaters, the soot falls into a hopper, from which it is extracted by a screw conveyor. It then drops into an ash basement through chutes fitted with double flap valves which form an air seal. Each chimney has a Davidson grit catcher—see Fig. 11 on page 425—which collects the bulk of the grit from the flue gases. As, at the time when the contract for the boilers was placed, very scanty information was available concerning air heating, it was decided not to raise the temperature above 250 deg. Fah. Economisers have, therefore, been installed in addition to the air heaters, and by utilising the ejector and other drains and by the use of steam bled from a low-pressure stage of the turbines, the condensate is heated to 160 deg. Fah. before it enters the economisers. The diversity of opinion concerning the relative merits of cast iron and cast steel economisers led to the conclusion that it was desirable to test both types. Five of the boilers were accordingly fitted with cast iron economisers and the remaining boiler with a steel tube economiser which has apparently proved the more satisfactory, as the three new boilers are to be fitted with economisers of that type. By-pass flues are provided, so that the economisers and air heaters can be cut out of action if required. The steam ranges from the boilers feed into receivers—see Fig. 7—from which pipes feeding the main turbines, the steam-driven pumps and the oil heaters, &c., are connected. These receivers are below the level of the firing floor and the turbine platform, but the operating spindles from the valves adjacent to the receiver pass through the concrete

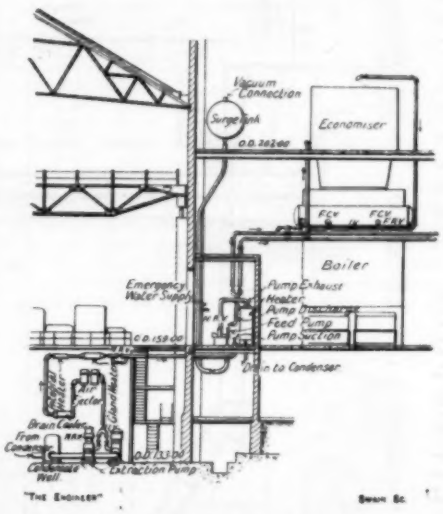


FIG. 8—FEED WATER SYSTEM

floor above into the steam control-room—see Fig. 12 on page 425—so that in the event of a steam joint failing or a similar mishap, it is still possible to operate the valves without danger or difficulty.

The feed pump-room forms an annexe to the turbine-house, and it is on the turbine platform level, which is also the firing level of the boiler-house. Four feed pumps are at present in use. Two are motor-driven and two are coupled to high-speed turbines, the pumps in the latter case having surface heaters on the discharge side, so that the exhaust steam may be utilised to heat the feed water. The feed system is "closed." The water that is discharged from the extraction pumps is fed direct to the feed pumps and a branch pipe is run off this service direct into a surge tank, which is kept under vacuum. At no point in the feed system is the water exposed to the atmosphere. Hence it is delivered into the economisers and boilers practically free from dissolved oxygen, a factor which modern experience has shown to be vital in order to reduce the corrosion of tubes. The surge tank, which is shown in Fig. 8, is situated at such a height that, when it is nearly empty and under vacuum, there is always a 10ft. head on the suction of the boiler feed pumps, the bottom of the tank being actually 40ft. above the suction. The surge tank compensates for any variations between the quantity of water discharged by the extraction pumps, and that required by the boiler feed pumps. With all the turbine auxiliaries we shall deal in our next article, but we may say here that, in accordance with modern practice, the make-up water to the boilers is supplied from an evaporator heated with steam bled from the turbines, and the evaporated water is discharged in the form of steam into the condenser. The sludge left on the raw water side is discharged to waste by a sludge pump. It will be seen that, as in other modern stations, every precaution has been taken to use water which is pure and free from air and free oxygen. By these means it has been possible practically to eliminate scale in the boilers and economisers and to avoid corrosion.

(To be continued.)

NO. 3 LISTER DRIVE POWER STATION, LIVERPOOL

MR. P. J. ROBINSON, M.I.E.E., LIVERPOOL, ENGINEER

(*For description see opposite page*)

FIG. 9—MOTOR-DRIVEN OIL FUEL PUMPS

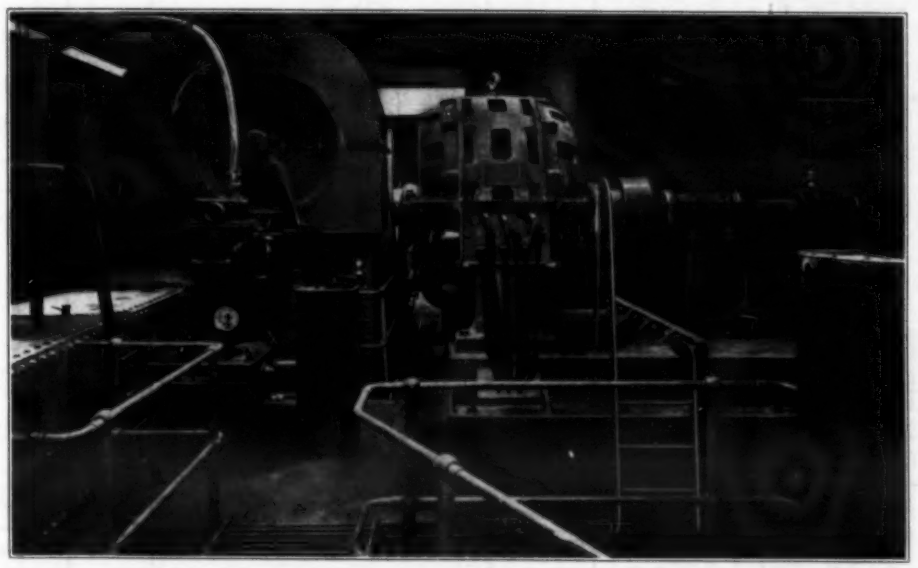


FIG. 10—MOTOR-DRIVEN FAN

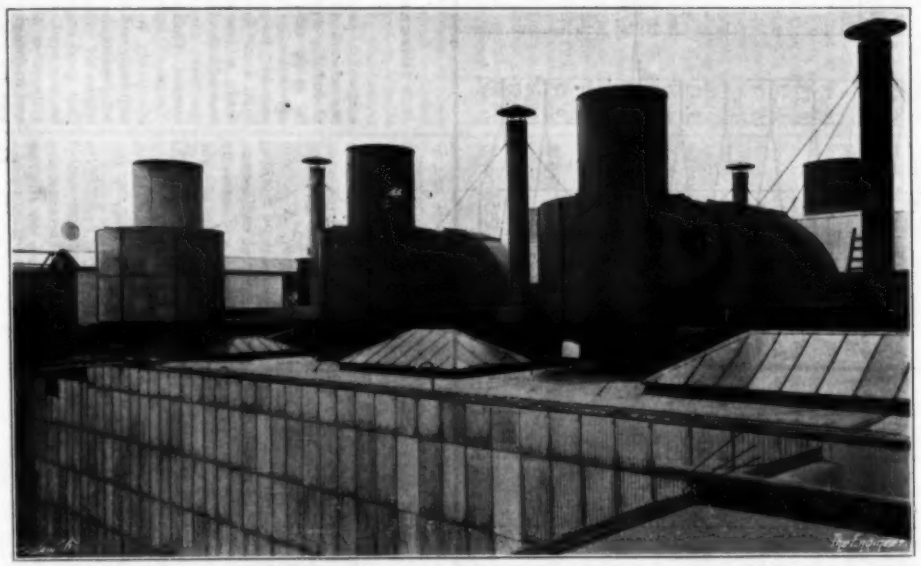


FIG. 11—CHIMNEYS AND DAVIDSON GRIT CATCHERS

FIG. 12—STEAM CONTROL ROOM

The Diagramming of Locomotive Workings.

By J. G. B. SAMS, A.M. Inst. M.E., M. Inst. L.E.

It must be very plain to all that the economical arrangement of the workings of locomotive engines are very complicated, and a matter for well-trained experts on each railway, observing that it is necessary to economy that every engine should run as many train-miles and as few light miles as possible in the minimum number of hours actually under steam per each lighting-up. It is also essential that the working of each engine be arranged so that the crew do not have excessive hours of duty, which means that the arrangements must allow of the crew being relieved by a fresh set of men somewhere near the expiry of their herein lies the best part of the work of the diagram arrangers, who must keep abreast of all alterations and additions, and at the same time work in all extra and special trains as economically as possible.

In the first place, let us review the chief rules governing the manning of engines. All duties must be arranged on an eight-hour day basis, and work, or a day's pay in lieu, has to be found for all drivers and firemen on every week-day. Duties commencing at any moment on Sundays may not count for a day's work in place of an idle day during the week. Thus a turn of duty lasting from 11.55 p.m. on a Sunday to 7.55 a.m. on a Monday is a Sunday turn pure and simple, and a new turn of duty or a day's pay in lieu, must be found for this particular crew, starting at some later hour after the expiry of a proper rest period of eight hours on the same day.

Sundays and overtime are paid for at enhanced rates, and extra pay is given for long mileage irrespective of hours worked, the mileage being reckoned as 120 miles to one day's pay, all miles beyond that figure being paid for at the rate of 15 miles to an hour's pay. In order to save overtime, it is frequently necessary to have an engine prepared by a "shed crew," who, in addition to preparation, sometimes work the engine from the shed on to the train, where they are relieved by the regular "road" men. A similar relief is sometimes necessary at the end of the turn, and examples will be cited of these arrangements. These shedmen are always juniors, often being "acting" rates—men passed for the higher rate but substantively in the lower—who take the higher rate when required, and the system of preparing engines for the road by juniors is usually considered undesirable, and consequently to be avoided, as it is known to informed circles that good enginemen prefer to prepare their own engines for the road, rather than be compelled to trust to others. Experience also is tending to show, both in this country and in America, that these juniors do not expend as much care on—to them—casual engines as the regular road crews are known to do, which in the end leads to an increase in failures on the road and heavier repairs bills. But if hours are to be kept down to a minimum, it cannot always be avoided.

As the duties of putting the engines away in the shed at the end of the day's work are comparatively unimportant they may freely be left to shed crews without prejudice to repairs or failures. Here it may be remarked that the time allowance for the preparation of engines is 45 minutes for those under 1500 square feet of heating surface, and 60 minutes for those over 1500 square feet.

The manning of engines on the foregoing principles can readily be divided into six principal methods, namely:

(1) Single crews daily.
(2) Double crews daily.
(3) Treble crews daily.
(4) Single crews on two-day trips working from both ends.
(5) The same, but working from one end only.
(6) Changing footplates *en route*.

First Method.—A single crew will take their engine out

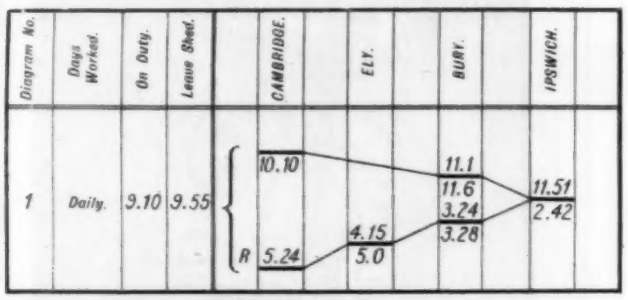


Diagram A.

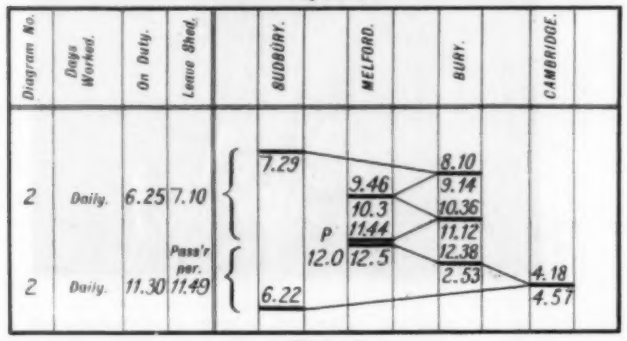


Diagram B.

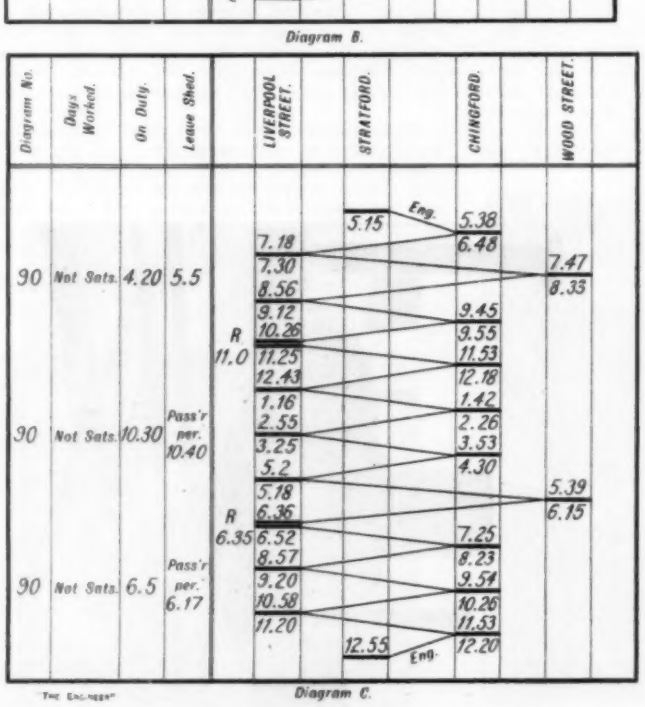


Diagram C.

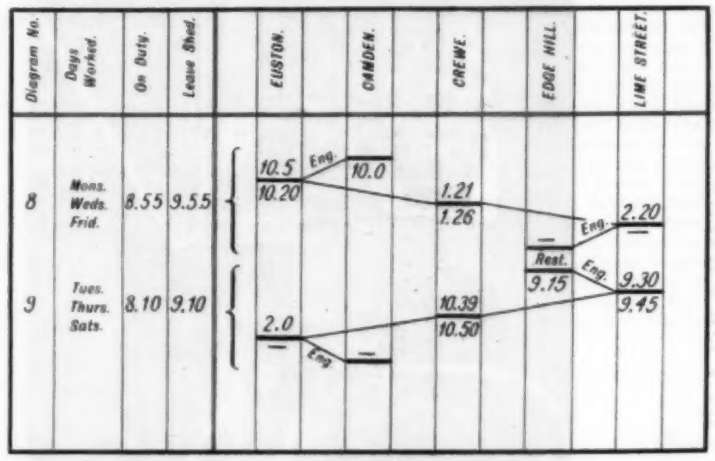


Diagram D.

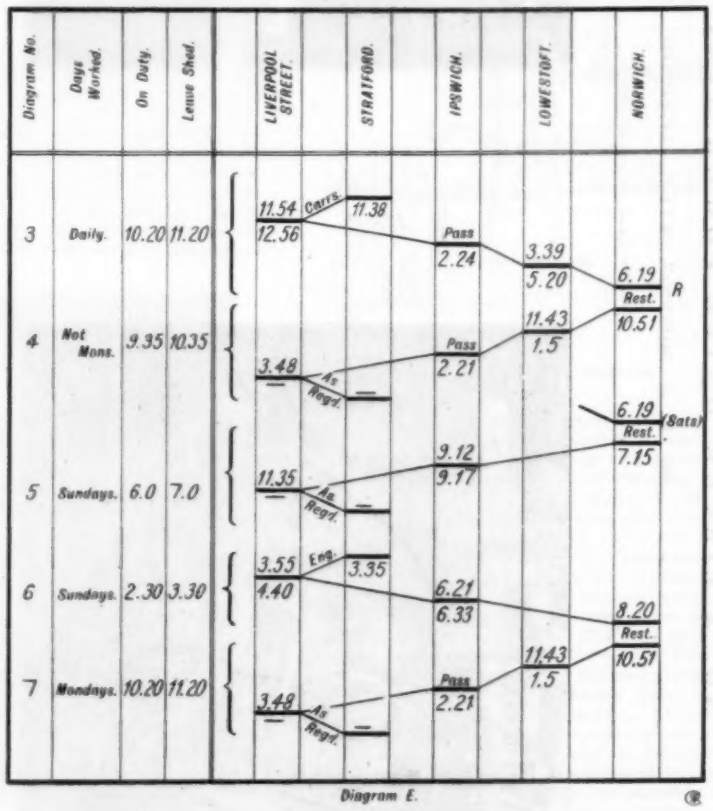


Diagram E.

Diagrams of Locomotive Workings

The following remarks are intended to be helpful to those about to start their railway career whether in the traffic or locomotive departments; in addition, perhaps, they may be found informative to those in more responsible positions who may be looking for a new idea. The examples given have been taken from recent practice on English railways; but, of course, they may not be the actual workings at the moment, as alterations in the time-tables, and consequently to the engine workings, are frequent, and

daily eight hours, or that the engine must arrive at a running shed somewhere about the expiry of that period—its base shed, if the working be a daily one, or a foreign shed if it be a working covering two days. A certain amount of latitude in hours is allowable, but no working should exceed ten hours for any one crew of enginemen, and workings under the eight-hour period are naturally uneconomical, as the men are paid for a minimum of eight hours per turn of duty, work or no work. This short working, however, cannot always be avoided.

of the shed, perform the day's mileage according to diagram, return to their base shed and put their engine away themselves, if hours permit. If the turn be over the eight hours, it may be necessary for shedmen to prepare for the road or to dispose of the engine afterwards, or perhaps to perform both offices. Diagram A illustrates this method, which is obviously a small engine working, as only 45 minutes are allowed for preparation, which is diagrammed to be done by the road crew. Fifteen minutes are shown to be allowed in which to clear the shed and attach to the train, which is shown to leave for Ipswich at 10.10 a.m., 15 minutes being the usual minimum allowance, applicable to cases in which the running shed is right on the station. When this is not the case, more time, according to distance to be traversed and obstructions in the shape of traffic delays likely to be met, must be allowed, otherwise there will be a danger of delays to the starting of trains. As there are two routes between Cambridge and Ipswich, it is necessary to indicate the correct route on the diagram by showing the times of the train concerned at an intermediate station—generally the most important one—on the route traversed. In this case the train proceeds *vid* Bury to Ipswich, where it arrives at 11.51 a.m.;

the engine returning to Ely, *viâ* Bury, on the 2.42 p.m. train, working back from Ely to Cambridge on the 5.0 p.m. thence, the road crew being relieved on arrival at Cambridge by a shed crew, who put the engine away in the shed after the disposal of the train and any other shunting that may be required by the traffic department. The relief is necessary, as the road crew's hours expired at 5.10 p.m.

A word as to the conventions used on all the diagrams reproduced. All departure times are shown under the horizontal line, all arrival times being over it; these times referring to the station named at the head of the column in which they are to be found. Two parallel lines between the arrival and departure times at a station with an "R" opposite indicate that the first crew is relieved at that station by a second crew at the time shown. An "R" at the final arrival time indicates that the road crew is to be relieved on arrival by a shed crew.

"P" and a time indicate that crews have to travel as passengers between their base and the station at which the relief is diagrammed to take place, the actual relief taking place at the time shown. "Eng." or "Carrs." indicate a light engine or empty carriage train as the case may be; and the sloping lines indicate trains—including light engines—but the slope has no reference to the speed of the trains, being merely an indication that the train represented is one between the stations connected on the diagram running in the times given.

To return to diagram A. Summarised, this diagram consists of approximately 3 hours 35 minutes of actual train working with two intermediate terminals, the total train-mileage being 121 miles, the wages amounting to one day plus fifteen minutes' overtime for the road crew and a varying proportion of a shed crew's day's pay for putting the engine away, probably about a quarter-day on the average, the totals coming out fairly well for one lighting-up and a single road crew.

Second Method.—Diagram B represents the daily working of a double-crewed country branch engine under 1500 square feet of heating surface. The first crew work along the branch until relieved by the second crew who have travelled from their base to the relieving point by the train booked on the diagram. The first crew will return when relieved by the first available train, their hours of duty ceasing with its arrival at their base station—Sudbury on the diagram—the hours of duty of the relieving crew commencing at the booked time of departure of the train by which they are ordered to travel from their base. This diagram analysed consists of 5 hours 40 minutes of actual train-working with a mileage of 140¼, inclusive of six intermediate terminals per one lighting-up. The mileage and working generally would appear to be fairly good for the expense of a double-crewed engine on this class of work—country branches with an infrequent train service. One of the snags of this arrangement is that the engine must either be at, or else close to, the base station at or about the time that relief ought to take place; the latter case requiring a convenient train in each direction in order that the two crews may travel to and from the relief-point without waste of time. This may sometimes necessitate the running of the engine light back to the base for relief to take place.

Third Method.—This is chiefly applicable to suburban services starting early in the morning and finishing late at night, accessibility for reliefs being a necessity. The first crew will take their engine from the shed and work through the diagram until relieved at the predetermined point by the second crew, who, as the service on which they are engaged does not permit them to finish out the working without excessive overtime, have to be relieved by a third crew who finish out the working and finally put the engine away in the shed. This three-crew method is also used for "continuous" engines, that is, engines at work—such as shunting engines in busy yards—without a daily break in the shed, some of these engines hardly seeing the shed once a week. The relief crews for such engines are allowed "walking-time" to get from the shed to the engine, according to distance to be walked and time that may be taken in trains *en route* from the base to the shunting yard.

Returning to the diagram working, this requires that the engine be arranged to work a suitable train about the time necessary for relief through the base station, or as this is often impossible, through a nearby suitable station or to a convenient terminus. It is not always possible to avoid a little overtime under this method owing to the trains not being conveniently timed for relief purposes, but what there is, is of a minor quantity.

Diagram C illustrates a three-crew suburban working, the engine proceeding light from its base (Stratford) to the commencing terminus (Chingford), from whence it begins the day's work. Ten minutes are allowed to get from the shed to the main line, and this is noted on the diagram. The convenient terminus for relief is Liverpool-street Station, and the relief crews are booked on at Stratford about half an hour previous to their booked time for relief, this allowance varying according to the convenience of the train service between Stratford and Liverpool-street. On relief, the relieved men return home by the next train, their time expiring at Stratford Station, the final set of men working the engine home after finishing out. Owing to the rush of engines coming in during the late evening at many large sheds, it frequently takes about ninety minutes or even more to dispose of the engine in the shed owing to congestion at the ashpits and the coal stage, which in this instance would only allow about two hours in the shed for the purpose of cleaning the engine and affecting any minor repair booked against the engine. In these short margins, the fire is usually left in after its cleaning over the ashpits.

This particular diagram gives an actual train-working time of 8¼ hours with a train-mileage of 175 miles for the expense of a day's wages and perhaps a fragment of overtime for the last shift for the three crews, which is good considering that there are nineteen intermediate termini.

Fourth Method.—This method is used in connection with long-distance train working, and is illustrated by diagram D. Here an engine and crew work a down train (say) to a far point, and as the unexpired hours of duty do not admit of a return train without excessive overtime, the engine is put away in the foreign shed and the crew booked off until the following day, when they will work an up train to bring them home again. This working involves two engines and two sets of men, as one engine can obviously only work in the same direction on every other day. As it is presumed that this train service is a daily one, a daily start must be made from each end by an engine belonging to that end. If a train in each direction on Sundays be imported into the working, it would be possible to run this method from one end only by sending one of the engines to the far end so as to make a start from there.

Looking at diagram D, which refers to the London engine and men of a pair engaged on this working, it is seen that the down trip runs on Mondays, Wednesdays and Fridays, returning with the up trips on the next day in each case. The complementary Liverpool engine works in the alternative direction to the above, so that the trains are engined daily and engines and men return to their bases every Tuesday, Thursday and Saturday, thus avoiding lodging away over the week-end or travelling as passengers homeward in lieu. The diagram as shown can be converted into the complementary Liverpool working by putting the second half of the diagram as shown before the first half and altering the "rest" from Edge Hill to Camden.

The disadvantage of this arrangement is that the crews in each case have to take rest away from home, incurring six sets of lodging expenses thereby, but otherwise the arrangement is a very good one, as it gives 181 train miles in about four hours of actual train working for one day and four hours' wages per lighting-up, and there are no intermediate termini, consequently the engine is under steam for the absolute minimum of hours. In selecting trains to be worked with this method, usually referred to as a "crossed" working, care must be taken to allow sufficient time for the crews' rest between the turns of duty, but at the same time it must not be too long, as lodging expenses increase in rate per hour after the expiry of twenty-eight hours away from the base station.

Fifth Method: Diagram E.—In order to fill out hours of duty still available and to increase the miles run per lighting-up, a local train is added to the main line working on this diagram, which typifies a two-day working from one end, covering seven days per week and requiring two engines and sets of men. The inclusion of Sundays will be seen to be necessary in order to return the down Saturday engine and men and to provide for the up Monday working; without this the men would have to lodge out over the week-end, which would be expensive under the sliding scale mentioned above.

Coming to details of working, on Mondays to Fridays inclusive the engine and men of the 12.56 p.m. ex Liverpool-street work the 5.20 p.m. local train from Lowestoft to Norwich, book off duty and then take rest; coming on duty the next day to work the 10.51 a.m. local back to Lowestoft, thence the 1.5 p.m. express train to London. The engine and men for the 10.51 up local on Mondays have come direct from London—as shown—on Sunday with the 4.40 p.m. down train thence to Norwich, while the engine and men that have arrived on the Saturday with the 5.20 p.m. ex Lowestoft are utilised to work the 7.15 a.m. Sunday train, Norwich to London direct, proceeding thence "as required" by the empty carriage train working of the moment, these "as required" movements being usually left to the discretion of the local locomotive foreman working in co-operation with the traffic requirements. To show this Sunday working, the final fragment of the Saturday's diagram is repeated in conjunction with the entire Sunday diagram. Here it may be said that the word "pass" in a station column over a time indicates that the train is booked to pass through that station without stopping at the time mentioned.

The working shown in diagram E gives a train mileage of 145 miles for five hours actual train working with one intermediate terminus, which is hardly as good a case as the previous example.

Sixth Method.—It is sometimes advisable to change footplates *en route* in order either to save overtime or to get men back to their base station. This cannot very well be done in the case of two passenger trains, but it is workable in the following cases, namely, between two goods trains, between a passenger and a goods train, or between two passenger engines meeting in a locomotive yard. As a passenger train is usually only allowed a minute or two at a station, a change of engine crews between it and a passing goods train necessitates the presence of the goods engine crew on the platform in readiness to step on to the passenger engine immediately on arrival, thus leaving the goods engine without a crew for the space of a few minutes while the change is taking place. This method is often used between goods trains meeting at a station unprovided with a turntable in order to avoid the tender-first running that would ensue if the engines as well as the crews were to be changed over; but it is not considered a desirable system, as it tends to increase the pooling of engines, pooling being apt to foster neglect and so increase the quantity and cost of repairs, but it is a useful scheme at times for the avoidance of lodging-out expenses and of tender-first running.

Duty List.—The enginemen are usually advised of their prospective turns of duty by a "duty list," which is posted in one or more prominent positions about the running shed. Small sheds steaming up to three or four engines on regular schedules do not need such a list, as all the enginemen know all their turns by heart, and any casual alteration can be passed on to the men concerned by the man in charge, either in writing or by word of mouth. The duty list should be ruled in vertical columns, with spaces for the engine number, the names of the drivers and of the firemen, the number of the diagram to be worked, the time the engine is due to leave the shed, the time at which relief is to take place, and a wide "Remarks" column in which may be entered the train by which relief men are booked to travel, temporary alterations of diagram working, recent repairs and overhauls done to the engine which call for an extra amount of watchfulness on behalf of the enginemen, &c. &c.

Relieving crews can be shown immediately under the crew that they are to relieve, but shed preparing and relief crews are best shown by themselves, each with a list of the engines that they are expected to prepare, or relieve and put away after. The road crews will know from their diagram what reliefs or preparation they are to receive. It is very necessary to advise enginemen of recent repairs, &c., to their engine through the duty list as well as by word of mouth, as many a newly adjusted big end, &c., has again given out through lack of the necessary additional attention, the excuse given by the culprits being that they had no knowledge of the matter whatever, and this is particularly applicable to engines and men working in a pool.

Neglecting additional wages cost, it is an indisputable fact that the recent reduction of enginemen's hours from ten to eight have complicated matters very considerably and have thrown additional burdens on to the railway companies. The relevant facts are that the running sheds and marshalling yards have grown up very largely on a ten-hour day basis; enginemen's hours ought to be longer than those of the train crews, as they have more duties to perform before and after the actual departure and arrival of their first and last trains, and there is much unavoidable waste of time at intermediate termini, reducing the net hours of work of both engine and crew, to say nothing of the waste in coal and wages. At a terminus it must be remembered also that an engine working in a train of carriages, generally speaking, cannot work the same train out again, but must wait for it to be worked away by a second engine, the first engine remaining in idleness until another train brought in by a third engine is ready to be worked away. This is not so with guards and other members of the train crew, who can always leave with the train that they have brought in.

The reduction has also increased engine changing *en route*, which carries with it an increase in intermediate terminals; a great deal of double and treble manning where formerly single and double manning was sufficient; also the increase of the pooling system and of preparation crews. All of these represent additional expense and the engine changing additional complications for the diagramming staff as well as otherwise avoidable waste. Preparation crews represent waste, as in the busiest sheds they cannot be utilised all their time, observing that engines booked for preparation never follow each other at regular intervals, and it frequently happens that such a crew will only prepare two or three engines for a day's work representing a useful "day" of perhaps four hours. For the rest of their time they are "under shed foreman's orders," which usually means sitting in the mess-room waiting for something to turn up. An examination of engine workings will show that there is seldom more than five hours—generally far less—of net train working per crew in any turn excepting in those cases where the engines are prepared by shedmen or the roadmen are relieved on arrival, or where mileage runs are worked. A reasonable time for preparation, disposal, attaching, &c., is 2½ hours per turn of duty, so that the proportion of train working time to attention, &c., time is at the best 2 to 1. A ten-hour day would increase this ratio, as attention time would remain constant, while it is reasonable to expect that train working time would be advanced two hours from five to seven hours, so that the proportion would improve to nearly 3 to 1. This must mean in the long run less engines in steam, a very material economy indeed, as well as the doubling of single-trip engines, i.e., out-and-home-again runs with no lodging expenses instead of out one day, take rest, and return the next—applying the first method explained above instead of the fourth and fifth.

All these are very material points indeed that ought carefully to be considered both by the staff and the railway companies in connection with the return to prosperity without which no organisation can be expected to flourish, and it has been truly said by a prominent railway general manager that there is more money to be saved in the running department of a railway than anywhere else.

A final suggestion is that when compiling time tables or arranging new trains greater co-operation should exist between the locomotive and the traffic branches with a view of elimination of waste. The writer well remembers that some years ago, on his railway, two long-distance trains were put on without any corresponding up working, the results being a heavy light mileage and the overloading with returning stock of some of the up trains. Much improvement might also take place by the amending of the time table to suit the economical working of engines and rolling stock. One is also struck by the curious fact that at junction stations formerly frontiers between different railways now amalgamated, original services on both sides of the frontier still terminate there instead of being joined up and running through, with the attendant advantages of better engine and rolling stock use, less intermediate locomotive terminals, and improved public service. Here, again, co-operation might well step in, improve services and save waste.

NEW METHOD OF SHIPPING TRANSFORMERS.

A TROUBLESOME situation arose not long ago at the Sharon, Pa., plant of the Westinghouse Electric and Manufacturing Company, when it was found that the usual method of shipping transformers could not be followed in the case of a large unit destined for Oakland, Calif. Transformers usually leave the works filled with oil which, in this instance, would have meant so much more weight that the shipment could not have been handled at the receiving end. On the other hand, without the oil, it would have been necessary thoroughly to dry out the transformer upon its arrival at Oakland, and this would have involved not only delay but much expense. As a result, a new and entirely satisfactory method has been devised that greatly lessens the weight of the unit in transit. Before the transformer was shipped it was thoroughly dried and tested. After the cover was bolted in place, dry nitrogen was blown through the tank until the oxygen content of the gas in the tank was reduced to 1 per cent. More nitrogen was then introduced until the pressure within the case amounted to 2·95 lb. per square inch at 50 deg. Fah. The object of this was to keep out air and moisture. As an added precaution, a bag of calcium chloride was put in the tank to absorb any possible moisture and also to indicate its presence upon the delivery of the transformer. When the unit reached the sub-station it was discovered that the tank was under a pressure of 1·5 lb. per square inch at 59 deg. Fah., and that the oxygen content was 1·8 per cent. Likewise, the calcium chloride was quite dry. No time was lost in filling the transformer with oil and putting it in service. Thus, by the use of nitrogen, under pressure, it was possible to reduce the weight of the shipment by more than 32 tons.

A Powerful Floating Block-Setting Crane.

For use in connection with the important extensions which are now being carried out to the port of Algiers, a powerful floating block-setting crane has been built and put into service. In building the necessary moles and jetties, blocks of concrete of particularly large size are being employed. The majority measure 11 m. long by 4 m. wide and 4·1 m. deep, which means a content of over 6300 cubic feet. With concrete weighing 124 lb. per cubic foot, that represents a weight of some 350 tons, which are, as will be seen, formed with specially shaped recesses at the centre of their height, serve two purposes. In the first place, they receive the lifting tackle employed to raise and lower the blocks into position, and, secondly, when the blocks are placed the holes, which register one with another, are filled with concrete, so that the layers of blocks, if we may so express ourselves, are bonded together at four points.

On a platform at the top of the structure connecting the two pontoons together there is arranged a circular roller path, which is just over 50ft. in diameter. On it can revolve on rollers a house which is kept centred by another series of rollers with their axes vertical, and which contains the operating mechanism. The latter

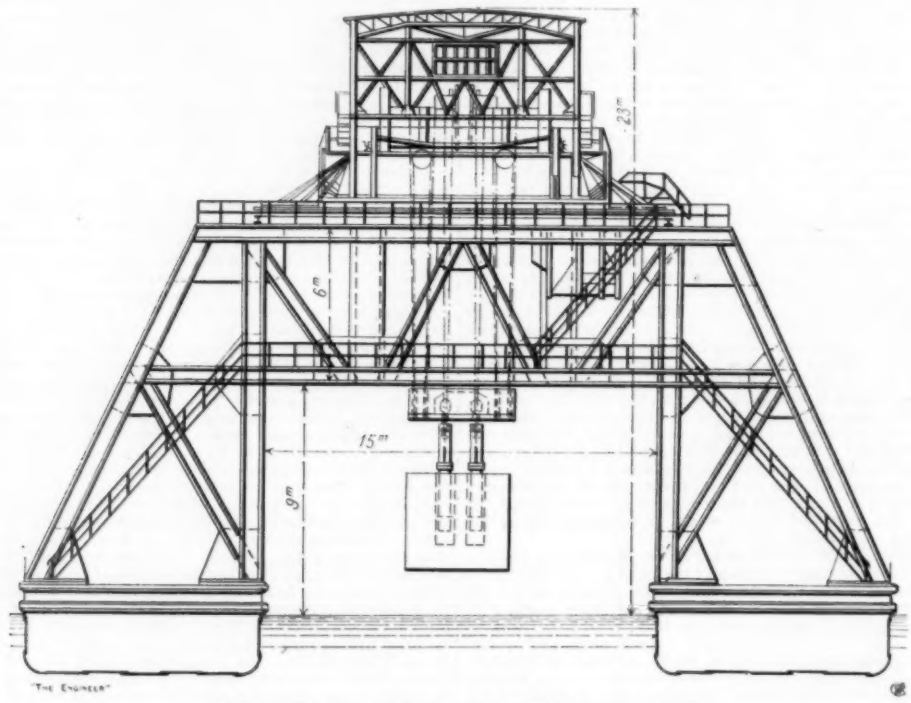


Fig. 1—450-Ton Floating Block-Setting Crane

and, since some of the blocks used are even heavier than that, the crane is capable of dealing with weights up to 450 tons.

In a recent issue our contemporary *Le Génie Civil* gave a detailed description of this crane, and the information contained in what follows, as well as the illustrations which accompany it, have been derived from that source. The crane in question, which is illustrated in Fig. 1, is of an entirely new type, its distinguishing feature, as contrasted with ordinary floating cranes, being that it comprises two pontoons which are connected together by means of a rigid superstructure built up of joists of heavy sections. The pontoons are arranged parallel with one another and comprises two winches, each of which is furnished with a 71 H.P. motor for lifting, and each of which can be traversed to and fro by a 28 H.P. motor, the speed of movement being 4 m. per minute. For revolving the winch house there are two motors, each of 28 H.P., and the house can be turned through a complete revolution in 3 minutes. From each winch there depends a swingle-tree which is furnished at either end with tackle, electrically operated, for engaging with the recesses in the four vertical holes in the blocks, there being four motors, each of 1·65 H.P. for this purpose. In operation, the blocks, which are brought to the site in lighters, are warped underneath the crane, the pontoons of which are securely moored and raised

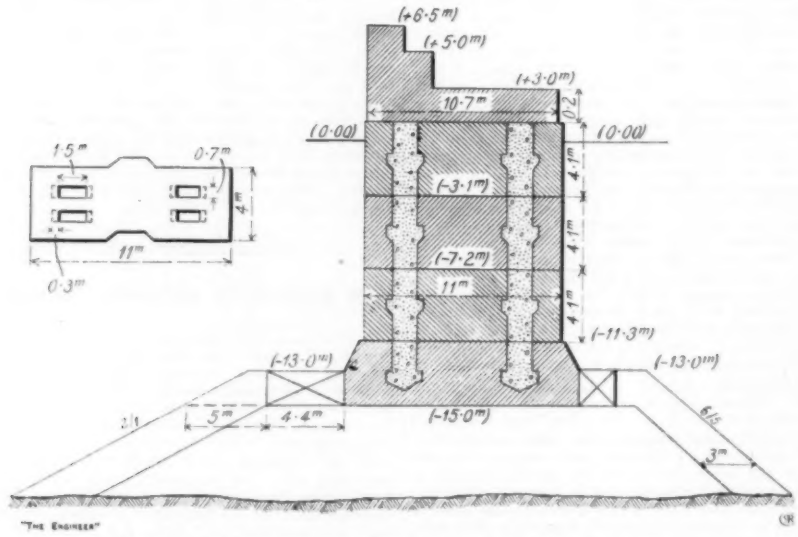


Fig. 2—Section of Concrete-Block Mole at Algiers

at a distance of 15 m., or just over 49ft. apart, and when putting the blocks in position they straddle the site on which the blocks are to be sunk. The crane, not being of the jib type, has no overhang, and the arrangements are such that the block can be got into exactly the position for lowering by adjustment of the crane mechanism and without having to make any movement of the pontoons.

The particular form of mole being built at the present time is shown in Fig. 2, which also shows in plan one of the blocks. It will be seen that the block has a projection on one side and an indentation on the other, these projections and indentations being of such form that adjacent blocks may key into and fit snugly one against the other. It will be observed that the blocks are each formed with four holes, which are, in all save the bottom block of a tier, taken down through the whole of their depth. These holes, sufficiently to clear the deck of the vessel. The latter is then moved out of the way and the block is lowered into position by the aid of divers working under water. The adjustments and the arrangements are such that the blocks can, we understand, be laid at the rate of one per hour, the various motions provided being such that it is a simple matter to manœuvre the block, notwithstanding its dimensions and weight, into exactly the required position. The controllers' cabin is suspended from the revolving portion of the structure, and revolves with it. The operator has thus an excellent view of the operations he is conducting. The blocks can be lifted at a speed of 0·7 m. per minute and lowered at 1·2 m. per minute.

In one of the pontoons there is a steam-driven plant for generating the electrical energy employed for operating the various motors. The plant consists of a Du Temple boiler, which operates at a pressure of 170 lb. per square inch, and supplies steam to a Larbordière engine of 240 H.P. which is coupled direct to a 110-kW Schneider direct-current, 250-volt generator. The equipment includes a condenser, with the necessary circulating water arrangements, a bilge pump, and the electric switches, &c., for the motors, as well as quarters for the crew.

The design of the crane was worked out by Les Etablissements Schneider et Cie. The pontoons and the general structure were built at Bordeaux and the electrical equipment at Champagne-sur-Seine. The pontoons were towed to Algiers where the crane was erected. Up to the time when the article from which we are quoting was written, more than 150 blocks varying in weight from 390 to 415 tons had been got into position. During July, when the weather conditions were particularly favourable, forty-two blocks were placed.

Marine Oil Engines.

The paper on "Marine Oil Engines," which was read by Mr. Sterry B. Freeman, M. Eng., M. Inst. C.E., M.I. Mech. E., at the meeting of the Diesel Engine Users Association, held on Friday, October 12th, was an able and interesting review of the present position of the oil engine as applied to marine propulsion. As an instance of the rapid adoption of this type of prime mover, Mr. Freeman quoted figures which showed that whereas in July, 1919, there were only 912 motor vessels aggregating 752,606 gross tons, in July last that number had been increased to 2933 ships with a total of over 5,432,300 tons. Analysing the returns for July, 1927, which were the last complete figures available, he then showed that out of a total of 2552 motor vessels representing 4,270,824 gross tons, over two-thirds were under 1000 gross tons, but 88, aggregating 956,081 tons, were over 8000 tons, representing about 22 per cent. of the total, and 241 were motor vessels of over 6000 tons each, aggregating 2,024,958 tons, or 47 per cent. of the total. Equally interesting figures given by the author were the July, 1928, returns for vessels propelled by different types of machinery. Out of a total of 65,159,413 tons, it was shown that steam reciprocating engines were installed in ships represented by an aggregate of 50,045,048, or 76·8 per cent. of the total; while steam turbine-propelled ships amounted to 1418 ships, with 9,682,063 tons, or 14·8 per cent.; and motor vessels to 2933 ships, with 5,432,302 tons, or 8·4 per cent. of the total.

Mr. Freeman regarded the British shipowner as keeping an open mind in facing the realities of international competition, and trying where conditions enabled him to help the coal industry of the country by taking advantage of improvements made in the efficiency of coal-burning installations. Evidence of such an attitude was to be found in the many experiments with higher steam pressures and temperatures, automatic stokers, and the use of pulverised fuel in water-tube boilers now being made. The law of engineering progress, which was to give the user more power from the material employed being followed both in the case of the marine steam engine and the marine oil engine.

The battle between the four-cycle and the two-cycle principles of operation still continued unabated, and a diagram was given showing the relative tonnages propelled by oil engines of the principal four-cycle and two-cycle single-acting and double-acting types. Looking at the matter from the shipowner's point of view, the author said that there was need in the marine world, at the present time, for an efficient standard type of engine which could be cheaply manufactured by any competent builder on the lines of mass production. Many makers now had their own standard engines, but what was wanted by the shipowner was an engine of accepted design; covering a large range of power, for which competitive prices could be obtained, the builders relying, as in the case of the triple-expansion steam engine, on their differing administrations and executive resources, to obtain the contracts which they desired. There had been some progress in the standardisation of engine parts, but Mr. Freeman thought we were possibly not far enough advanced on the road of oil engine development to crystallise existing practice as fully as the proposal of a standard engine would suggest. If the general cargo ship were to take full advantage of oil fuel something of that kind would be necessary in order to meet the competition of steam machinery.

The different kinds of oil engines now in marine service were then considered and were compared, as regards their weight, mean-indicated pressures, and relative sizes. Although the marine engineer had hitherto preferred engines of the long-stroke slow-running crosshead-type, the success of higher piston speeds and trunk type engines when fitted with centrifugal oil purifying apparatus were modifying the older views.

Means for increasing the output of marine engines by raising the mean indicated pressure, increasing piston speeds, using separate air compressors and scavenge pumps, along with the adoption of the double-acting principle and supercharging were then discussed. The author regarded the airless injection system as an improvement which had come to stay, and instanced the progress made in the utilisation of the heat of the exhaust gases for the purpose of raising steam.

The second part of the paper dealt with the marked advances recently made in the matter of materials. Cast steel, Mr. Freeman said, was now being increasingly employed for cylinder covers, piston heads, and combined crank webs, and balance weights, the physical characteristics of steels for crank shafts and top and bottom end bolts had been improved in the direction of increased tensile strength and limit of proportionality; and special heat-resisting steels were now obtainable for exhaust valves and seats. Special types of bronze, cupro-nickel and chromium-coated brass, all found uses for telescopic water-cooling pipes. The biggest advance of all had taken place in cast iron, and both makers and users had now realised that cast iron in its pearlitic state was in the best condition to resist wear, to develop high-tensile and elastic properties, and to be immune from growth when subjected to prolonged high temperatures. Some interesting examples of cylinder liner wear were given, which indicated conclusively the advantages of special cast irons of pearlitic

structure. Piston ring wear was also discussed, and examples given from actual engines. On the subject of crank shaft design and clearance the author remarked that the usual clearance on main journals of about one-thousandth of an inch per 2in. of diameter should be regarded as a minimum clearance. Increases beyond this amount might introduce higher lubricating oil pressures. The question of overhauling was bound up with that of the weight of parts per indicated horse-power is least for single-acting two-stroke engines, being about 23 lb., compared with 27 lb. for the four-stroke double-acting engine, and 29 lb. for the four-stroke single-acting engine.

With regard to running costs the fuel oil bill was the heaviest of all the charges, but it was not the only item which could make or mar an economical engine. The range of difference in fuel oil consumption for large marine oil engine was from 0·38 lb. up to 0·44 lb. per shaft horse-power for all purposes. Lubricating oil consumption was all important, and might vary from 4·42 gallons to 10·70 gallons per 1000 shaft horse-power. Of the total lubricating oil used in a ship about 84 per cent. of the cylinder oil was required for the main engines and 16 per cent. for the auxiliary engines. The compressor oil was in relation of two-thirds to one-third, and for the crank case oil about 40 per cent. of the total was required for the main engines, 20 per cent. for the auxiliary engines, and a further 40 per cent. for the pumps, &c. Figures were worked out for the combined annual cost of both fuel and lubricating oil for different types of machinery, and were shown to be the largest for the four-stroke double-acting engine, and the smallest for the same engine of the single-acting type; the two-stroke single and double-acting engines and the Still engine all had intermediate valves.

In considering the subject of repairs, which was dealt with at some length, the author stated that provided that breakdowns and consequent renewals were not met with, it was certain that the running costs of oil engines were not greater than those of steam engines. In conclusion, Mr. Freeman remarked that the oil engine is still expensive in first cost, compared with the steam engine, and it requires skilled and careful upkeep and operation, while the future price of its fuel is uncertain. On the other hand, the economy of space and weight—particularly that due to the saving in bunker weight—coupled with the fact that the oil owner can always apparently hold the price of oil at a level slightly more favourable to the shipowner than the price of coal, would seem to indicate that the coal-owners of this country will have to do all they can if they are to keep up with the progress of the oil engine.

Continental Foundry Training.

SOME interesting particulars of the facilities available on the Continent for the training of foundry engineers, and of the methods adopted for the instruction of foundry apprentices—it would appear that the foundry has as little attraction for the young men on the Continent as in this country—were given by Mr. V. Delpert before the London Branch of the Institute of British Foundrymen on Thursday, October 11th. One of the best examples of the really practical school in France, he said, is the Ecole Supérieure de Fonderie, or High School of Founding, established for the purpose of training foundry engineers, largely as the result of the efforts of the Syndicat General des Fondeurs de France.

The idea of a special school for the training of foundry engineers was expounded first by Monsieur Roncervy (chairman of the Training and Apprenticeship Committee of the Association Technique de Fonderie), who obtained the active support of the employers' organisation, and the support of the French Government was also obtained. The Ministry of Education shared in the financing of the enterprise to the extent of half the cost, the other half being furnished by the foundrymen's association. The board of directors consists of seven members designated by the Employers' Association and six by the Minister of Public Instruction, and the President of the employers' association is chairman of the board *ex officio*.

Candidates for the school come from two sources—the foundries themselves and the leading engineering schools. The foundry candidates must have spent at least one year's actual practice in the foundry, but next year this period is to be increased to eighteen months, and eventually to two years, experience having shown that those who have had the most practice derive the greatest benefits from the school studies. Those admitted from the foundries have to take a preparatory course, and before admission to the school they have to pass an examination.

Candidates from the recognised engineering schools must have had six months' actual practice in a foundry; they submit to the practical examination, but are exempted from the theoretical tests. The candidates from the shops submit to theoretical tests only. The object of the examination is not only to eliminate candidates in excess of the fixed number, but also to be sure that they have sufficient knowledge of mathematics, physics, chemistry, drawing, &c., on the one hand, and of foundry practice on the other, to enable them to follow the course with profit.

The course consists of about 160 lectures on practical and theoretical subjects pertaining to foundry practice, and seventy practical exercises, comprising laboratory work and actual practice in the foundry and pattern shop. During each lecture a certain amount of time is devoted to discussion. Each week the students visit a foundry plant, and once a month they report on these visits. At the end of the year's work a final test has to be passed, in which the students submit a complete mould and discuss it before the board of examiners, whilst they are also questioned on any subjects which have made up the year's course. This final test serves to classify the students as they come out of the school, but account is also taken of the average marks they have obtained during the year for their various studies, reports, &c. Even if they have satisfactorily fulfilled all these conditions, they are not granted the diploma of foundry engineer until six months after they have occupied a post in a foundry. At that time they have to submit a paper on a subject of their own choice. It must relate to their actual experience in the foundry, and it is only if this paper is considered satisfactory that the diploma is finally granted to the student.

Apprenticeship is not compulsory, but the employers' organisation is using its influence to make it compulsory in foundries of sufficient importance. It is recommended that each foundry should take each year from five to seven apprentices for every 100 workers. Apprentices should be paid, and their wage fixed at about the same level as that of unskilled workers of the same age. The apprentices are grouped together under the direction of a skilled moulder, and very satisfactory results have been achieved by that method. The period of training is generally three years, and it is only during the third year that the apprentices mix with the other workmen and work under the same conditions.

It might be asked what steps are being taken in this country to ensure the provision of proper facilities for the training of those in the foundry industry, and it is reassuring to know that the Institute of British Foundrymen, which has for long devoted attention to this matter, is now working in the direction of perfecting a scheme for the education of foundry workers and apprentices.

Light and Works Efficiency.

DURING the last few years production engineers and physicists have carefully investigated the effect of lighting on visual operation, and have conclusively shown that, in general, increased illumination brings about a greater output of work, and, in addition, improves the quality of that output. Electric light properly installed can be looked upon as an investment in industry which pays handsome dividends.

By means of lighting the eye is able to distinguish the shape and form of the object that is illuminated; for instance, the eye automatically associates certain gradations of light and shade with a round object or a vee-shaped object. Some operations require more light than others; continued work on small objects, for instance, requires a greater intensity of light for the same degree of eye comfort or efficiency than is required for larger objects, and it is, therefore, not surprising to find that there is a direct relationship between the amount of light available and the ability to perceive details. Experiments show that the eye takes a perceptible time in the process of seeing an object—in fact, the eye operates in a somewhat similar fashion to a camera; it is able to work faster in high intensities of illumination than it can under low intensities. There is, therefore, a time factor in seeing an object in just the same manner as in taking a photograph. Saving time, crowding extra useful seconds into every minute is the common objective of all efforts to improve efficiency. In a recent experiment it was found that under 10 foot-candles illumination, the eye took only two-thirds of the time to see the object than was necessary under 5 foot-candles illumination. This experiment has a practical application in a factory, for good lighting facilitates vision, saves small intervals of time on each operation, and, therefore, brings about increased works output.

The intensity of the light necessary varies according to the nature of the work, but in all cases the clearness with which the object can be seen is the vital factor. The smaller the work and the greater the detail, the greater the amount of light necessary to enable that work to be carried out, and illuminating engineers, as the result of experience, are able to specify the intensities which are necessary to permit different classes of work to be executed with accuracy and dispatch. The term "foot-candle" represents the unit of illumination in much the same way as the "degree" represents the unit of temperature, and illumination can be readily measured by simple portable photometers.

Modern electric light fittings are designed to control the "raw light of the lamp" so as to give the maximum amount of light on the working plane, and to do so with a minimum loss and the greatest effectiveness. Although the general illumination of horizontal surfaces is the more important, sufficient light must be available to light up vertical or oblique surfaces. A lighting system, properly designed as regards reflectors, lamps and spacing, will ensure evenness of light on the horizontal and adequate illumination for other surfaces. Crude and obsolete lighting equipment invariably produces dense and confusing shadows, while modern lighting equipment is designed to diffuse light efficiently from the large vitreous enamelled reflector or opal globes.

Glare of all kinds must be rigorously excluded from the modern workshop, since it is a direct cause of inefficiency in the working of the eye. In the presence of glare, the eye definitely loses a percentage of its efficiency, whether this be in its power to perceive detail or its ability to follow moving objects, to say nothing of the deleterious effect of glare in producing eye-strain or permanent damage to the delicate membranes. Direct glare may be due to a light source that is too bright, or to a light source that is too near the eye, or almost in direct line with the work.

The Home Office Departmental report strongly emphasises the importance of avoiding glare, and modern fittings and lamps are designed to do everything possible in this direction. Obsolete lighting equipment invariably accentuates glaring conditions.

Vision is sometimes hampered by direct reflection of light from bright or polished surfaces. Glare of this kind, frequently known as reflected glare, is particularly distressing, since the eye is less protected from glaring light coming in an upward direction. Reflected glare can be minimised by using highly diffusing forms of light equipment, such as obscured lamps in reflectors or industrial diffusing units. In each instance the aim is to increase the area of the light source. Occasionally indirect glare can be avoided by changing the relative position of the workmen and the light sources.

It is surprising how few factories have well supervised or well-planned systems for cleaning lamps, reflectors, and the maintenance of the electric lighting system in general. A recent survey of the prevailing conditions in factories shows that only 20 per cent. of the equipment could be considered clean, and therefore operating at maximum efficiency. It is surely not realised to what a tremendous extent dirt and dust reduce the intensity of the illumination. Tests show that dirty equipment may account for a drop of 30 per cent. or more in the value of lighting obtained on the work bench.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

PERMEABILITY AND PERMITTIVITY.

SIR,—I have read with interest your report of Professor E. W. Marchant's contribution to the discussion of electrical terms and definitions at the recent British Association meeting in Glasgow, published in your issue for September 28th, 1928. In discussing the nature of permeability and permittivity, Professor Marchant states that there is a difference between magnetised particles and electrically polarised particles in the respect that the polarised particles due to an electric field are not caused by the turning of permanently electrically polarised particles, but by the distortion of the orbits of the electrons, which were rotating in those particles. The distortion of the orbits, says Professor Marchant, produces the equivalent of an electric doublet, which in its electrical properties corresponds very closely with the magnetic properties of the magnetised particles or current rings.

This statement bears very closely on a series of experiments which I have just concluded, and the results of which I have communicated in full to the Physical Society of London. In these experiments I have found that the electric breakdown strength and the dielectric losses in dielectrics are very appreciably affected—generally to the detriment of the dielectrics as insulators—by magnetic fields superimposed on the test dielectric field. The explanation of this is—as Professor Smourov, of Leningrad, recently pointed out at Bologna in referring to my experiments—that the orbits of the electrons which are rotating in the atoms of the dielectric are distorted by the electric field, and as a result of their deflection the otherwise balanced magnetic field within the atom becomes unbalanced, and thus what is normally a magnetically neutral atom of a dielectric becomes magnetic. The effect of a strong magnetic field upon such "magnetised" atoms would appear to influence appreciably the "ionisation gradient" with the practical result that the dielectric properties of the material as a whole are affected. The magnitude of this practical result is dependent on the nature and direction of the magnetic field relatively to the electric field, but I have found that with magnetic fields analogous to those encountered in every-day electrical engineering practice, the insulating characteristics of ordinary commercial dielectrics can be so influenced as to give the material an actual insulating value from 3 to 20 per cent. less than that usually attributed to it by the ordinary—and now standardised—E.R.A. test methods.

I suggest that this phenomenon may interest many of your readers from a purely scientific point of view; but from a practical point of view I believe it has accounted for many until now unexplained extra high-tension electrical failures.

In conclusion, I would point out that the effect of a magnetic field on an electric field has been considered—and actually employed—by various investigators on gaseous dielectrics, but I imagine their observations have not always been correct, because, in fluids, "blow-out" effects produced by the magnetic fields on the leakage currents in the material, when near its point of breakdown, may be encountered, and these influences have masked the effect to which I have referred above.

ALLAN MONKHOUSE, M.I.E.E., A.M.I. Mech. E.,
c.o. Metropolitan-Vickers Electrical Co., Ltd.
Leningrad, U.S.S.R.,
October 7th.

THE INTEGRITY OF THE TECHNICAL MAN.

THE Presidential address which Mr. L. H. Hounsfield delivered to the Institution of Automobile Engineers on October 2nd was quite out of the ordinary. The author, under the title which we have used above, discussed the difficulty of securing perfect integrity in the automobile world, and urged the importance of training youths in business integrity as soundly as in the integrity of sport. In one section of the address he discussed in detail the temptations to lapse which beset each vocation in the motor car industry from the designer to the consultant. Of the latter he said:—

"The *consultant* is in an unfortunate position in that his services are usually not sought until it is too late. The average motor user is like the foolish man who never goes to the dentist till the tooth aches, when he probably has to lose the tooth. Although when a consultant is called in his action should be perfectly clear and free from all suspicion, it is an unfortunate fact—for which possibly consultants may be in part responsible—that the average man in the street looks upon a consultant or expert witness as a man upon whom he can call to say whatever he wants him to say, whether it be right or wrong, because he is paid to do so. He is regarded as occupying the same position in the automobile industry as legal counsel occupies in law. This is a deplorable state of affairs, and will undoubtedly take a lot of living down. There are movements directed to secure the same recognition of integrity among engineering consultants as exists, for instance, in the medical profession."

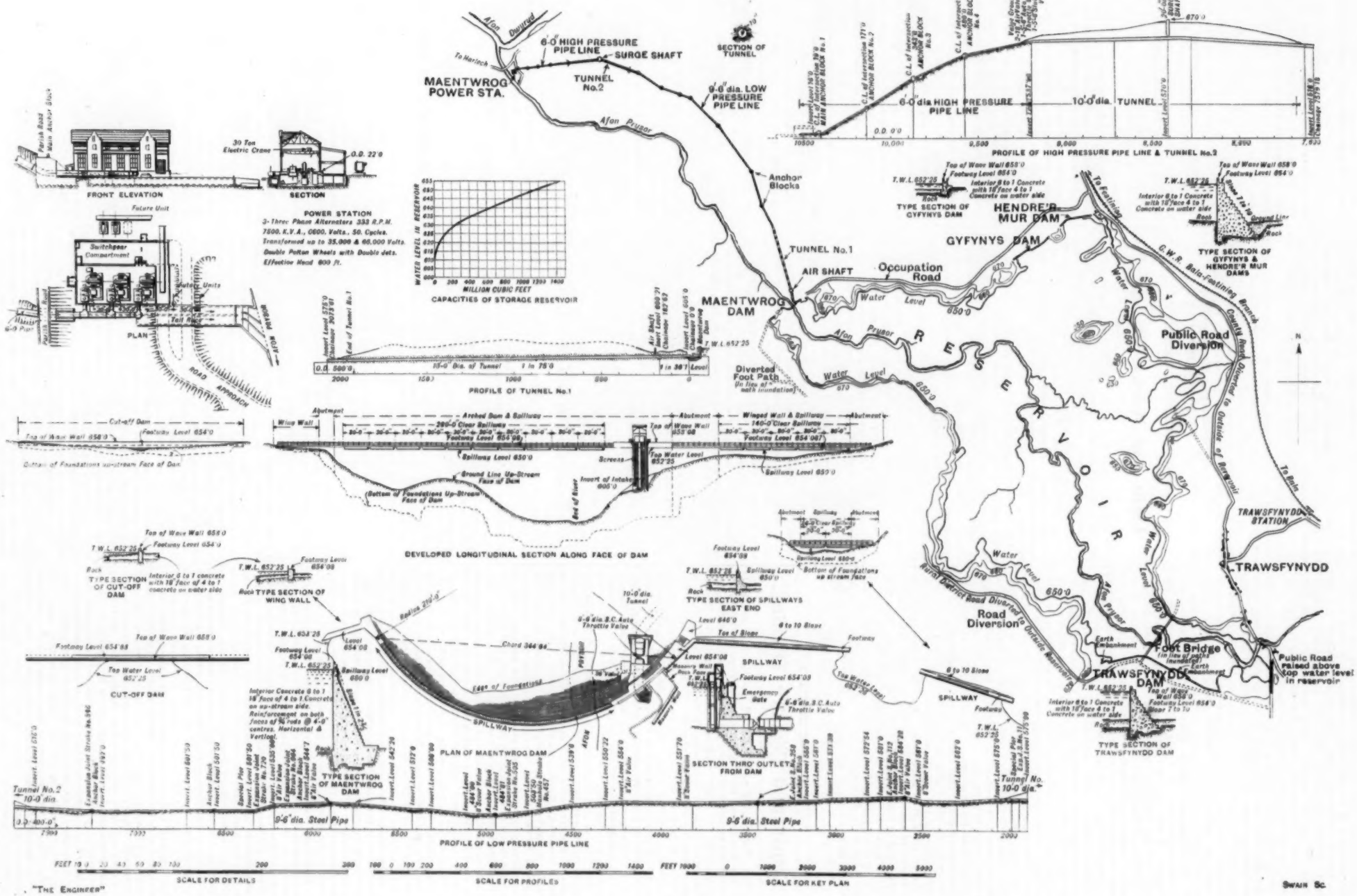
The address deserves to be read not only by those in the motor car industry but by all who deplore any want of integrity in business.

IN view of the engineering interests connected with Dundee it may be noted that third-class sleeping accommodation is now promised on the 11.5 p.m. from Euston and on the 9·20 p.m. from Dundee West.

THE MAENTWROG HYDRO-ELECTRIC POWER STATION AND RESERVOIR

MESSRS. SIR DOUGLAS FOX AND PARTNERS, WESTMINSTER, ENGINEERS

(For description see opposite page)

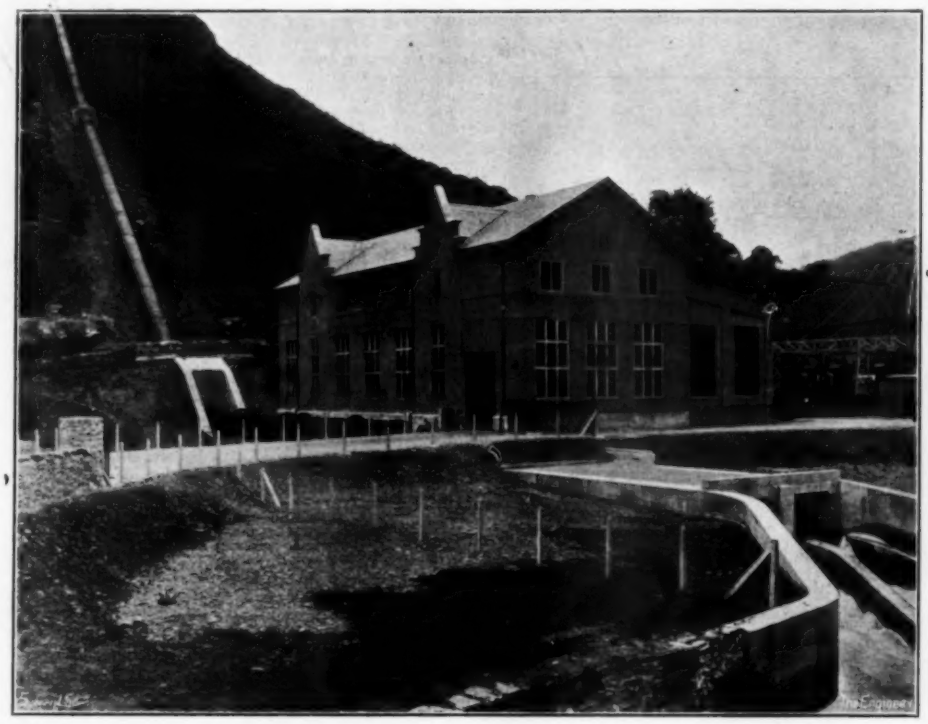


The Maentwrog Generating Station and Electricity Supply in North Wales.

No. I.

The Maentwrog hydro-electric generating station of the North Wales Power Company, Ltd., was formally opened and put into service on Monday last, October 15th, by Mrs. Wilfred Ashley, the wife of the Minister of Transport. The ceremony marked the completion of another stage in the extensive scheme of development by means of which the whole of North Wales has now, or will very shortly have, the benefit of obtaining supplies of electric energy.

Before going on to describe the station a few words regarding the Power Company itself and the scope of its operations may not be out of place. By the North Wales Electric Power Act of 1904 the North Wales Power and Traction Company, Ltd., was authorised to supply electric power in bulk and for power purposes within an area comprising the three counties of Caernarvon, Merioneth, and Anglesey, and part of Denbighshire. In the original scheme power was obtained from Llyn Llydaw and the watersheds of the Snowdon Range, which are among the most rainy districts in the British Isles, the precipitation varying from 125in. to 193in. per annum. A generating station was built at Cwm Dyli, Beddgelert, the contractors for the machinery being Bruce Peebles and Co., Ltd., of Edinburgh. This station, which has been in continuous operation since 1906, now contains four 1500 kVA, 50-cycle, three-phase generators, which formed the original installation, and one 2000 kVA, three-phase generator, which was added in 1923. Each unit comprises a turbine of the horizontal impulse type, running at 500 revolutions per minute, coupled direct to a generator and an exciter. All the turbines work under a head of 1130ft. The plant has an annual output of from eight to ten million units. From 1906 to 1918 the Power Company's system was entirely supplied from this station.



The Maentwrog Power Station and Pipe Line

After the passing of the Electricity (Supply) Act of 1919 a scheme for supply in a largely extended area was put forward by the Power Company. It formed the subject of an Inquiry, which was held by the Electricity Commissioners at Llandudno in 1921, and which resulted in the Order, dated August 3rd, 1923, constituting the North Wales and South Cheshire Electricity District, and constituting the North Wales and South Cheshire Joint Electricity Authority. Certain powers, rights and obligations of the Joint Authority were transferred by deed to the North Wales Power Company, which now operates, under the provisions contained in the Act of 1904 and the Order of 1923, throughout an extended area of supply covering 4080 square miles, reaching from Holyhead and Pwllheli in the west to Crewe in the east and embracing the whole of North Wales. The technical scheme put forward by the company provided for the development of the water power resources of the district and the establishment of a new hydro-electric power station at Maentwrog, with an installed capacity of not less than 15,000 kW, and it is that station which forms the subject of the present articles.

During the period of construction the demands on the company, which were rapidly increasing, were met by the purchase of power in bulk (*a*) from its associated company, the Aluminium Corporation, Ltd., and (*b*) from the Mersey Power Company, Ltd., the generating station of which is at Runcorn. The Aluminium Corporation built a new hydro-electric station with a capacity of 10,000 kW at Dolgarrog, in the Conway Valley, which was put into operation in 1925. The North Wales Power Company constructed a double circuit 33,000-volt overhead transmission line between Percival-lane, Runcorn, and a sub-station, which it had built at Crewe to meet the requirements of the London, Midland and Scottish Railway Company for the engineering works at Crewe, until such time as the generating station at Maentwrog was capable of furnishing a supply. We understand that, for some time past, current has been sent from the Welsh station to Crewe, and that now the famous railway works are entirely operated from that source.

The Maentwrog hydro-electric development is an exceedingly interesting undertaking, which has necessitated the carrying out of some extensive engineering works. We have referred to certain portions of it in a previous article, but in order to make these articles complete in themselves we propose to describe it in full detail on the present occasion, and we are enabled to do so by the courtesy of the consulting engineers for the scheme, Messrs. Sir Douglas Fox and Partners, of Westminster, who have furnished us with particulars and supplied us with the drawings which accompany these articles.

The power-house building is of steel-frame construction with brick filling, rough cast outside. A good deal of care has evidently been taken with the design of the building in order to preserve as far as possible the amenities of the district. Arrangements have been made so that it can be extended in order to house additional plant as and when the need for it arises. The generating plant for the initial development comprises three hydraulic turbines, each direct coupled to a 6000-kW, 7500-kVA, 6600-volt, 50-cycle, three-phase alternator. The turbines are designed to develop 9000 brake horse-power at 333 revolutions per minute with a maximum static head of 650ft. Each turbo-alternator set is arranged across the power-house and is connected to a 72in. diameter high-pressure pipe line by a 36in. diameter hydraulically-operated cast steel sluice valve. Each unit has three pedestal-type bearings having bushes of cast iron lined with Babbitt metal. These bearings are spherically seated and self-aligning. A belt-driven pump mounted on the bed-plate provides a continuous supply of oil to the bearings; the pump, with a vertical water-tube type oil cooler, sump tank and filter forming an integral part of the lubrication system.

The turbines, which are of the horizontal impulse type, are designed with two runners operated in a single casing, and keyed to the same shaft. Each runner carries twenty-two steel buckets bolted to the rim by fitted taper bolts and nuts with locking plates, the buckets being finely ground on the inside surfaces. There are four nozzles per turbine and they are so arranged that two jets impinge on the buckets of each runner. The needles are of the solid cylindrical type, and both needle tips and nozzles are of stainless steel.

Speed control is obtained by means of deflectors and needle valves. When the load is reduced the deflectors immediately come into operation and divert the jets from the runners. Directly afterwards the flow of the jets is diminished by the needles closing in towards their seats. We understand that even if the full load is suddenly thrown off the momentary increase of speed is limited to 10 per cent. Each complete rotor, before being installed, was given an over-speed test of 100 per cent.

The governor is of the evolvent type and is furnished with a centrifugal pendulum, the position of which, at any instant—except in the case of overspeed and underspeed—determines the position of the regulating valve. Oil under pressure is admitted by this valve to a differential servo motor. The piston of the latter, the position of which is determined by the pendulum just referred to, controls the needles and deflectors by means of rods and levers. The oil supply is obtained from a pressure tank which is fed by a rotary pump driven by belt from the main shaft of the turbine. In addition to the foregoing, there is a hand-controlled electrically-operated speed adjusting device, and each alternator control panel is fitted with a push button, for use in case of emergency, which shuts down the turbine and trips the machine circuit breaker.

Moreover, to provide against a runaway an automatic centrifugal device is incorporated in the governor pulley. On a predetermined overspeed being reached a spring-loaded valve trips and opens a discharge from the top of the regulating valve of the governor, which allows that valve to rise and to stop the turbine. The same device operates, in an inverse manner, when the speed falls below a predetermined minimum. The spring-loaded valve is furnished with contacts which are connected to the tripping mechanism of the circuit breaker.

The alternators, which are of the slow-speed salient-pole, 50-cycle, three-phase type, are designed for a maximum output of 6000 kW, 6600 volts at 333 revolutions per minute and at 0·8 power factor. Each machine has its own direct-coupled exciter, the armature of which is overhung. Forced ventilation is employed for cooling. The air is led through tunnels into a pit below the machine, the flow being controlled by hand-operated dampers in the inlet. From the pit the air is led to a fan inlet at either end of the machine by intake shields. The combined pressure set up by the fan and the poles forces most of the air through the radial ducts in the core, from which it is discharged to a chamber formed in the solid back of the frame. Part of the air, however, is by-passed through holes cored in the ends of the frame which serves to cover the overhanging parts of the stator end windings. Alternative means of exhausting the heated air are supplied in the form of top and bottom chimneys in the frame casting. The bottom chimney is arranged to discharge through a pit into a hot air duct which traverses the whole length of the station building.

The whole of the switchgear controlling the 35,000 and 6600-volt three-phase power supply which is transmitted from the station is of the metal-clad draw-out type. The main ten-panel 6600-volt switchboard accommodates (*a*) three oil-immersed circuit breakers of the draw-out type for controlling the three generators; (*b*) two circuit breakers for two 10,000 kVA banks of transformers for stepping up to 66,000 volts; (*c*) two circuit breakers for two 3500 kVA banks of transformers for stepping up to 35,000 volts; (*d*) one circuit breaker for a transformer which supplies current for the power station auxiliaries and for lighting; (*e*) one circuit breaker for an outgoing feeder; and (*f*) another for service as a bus-bar coupler. The oil circuit breakers have a breaking capacity of 350,000 kVA and the panels are of the duplicate bus-bar type. Merz-Price circulating current protection is provided for the generators and for the works transformer, plain overload protection being employed on the outgoing feeder circuits.

There is a five-panel, 35,000-volt switchboard, which is also of the duplicate bus-bar type. It accommodates two three-phase circuit breakers for controlling the two 3500 kVA transformer banks referred to above, and three circuit breakers for outgoing transmission lines to sub-stations at Llanfrothen, Dolgarrog and Oakeley. The circuit breakers on this board all have a breaking capacity of 500,000 kVA.

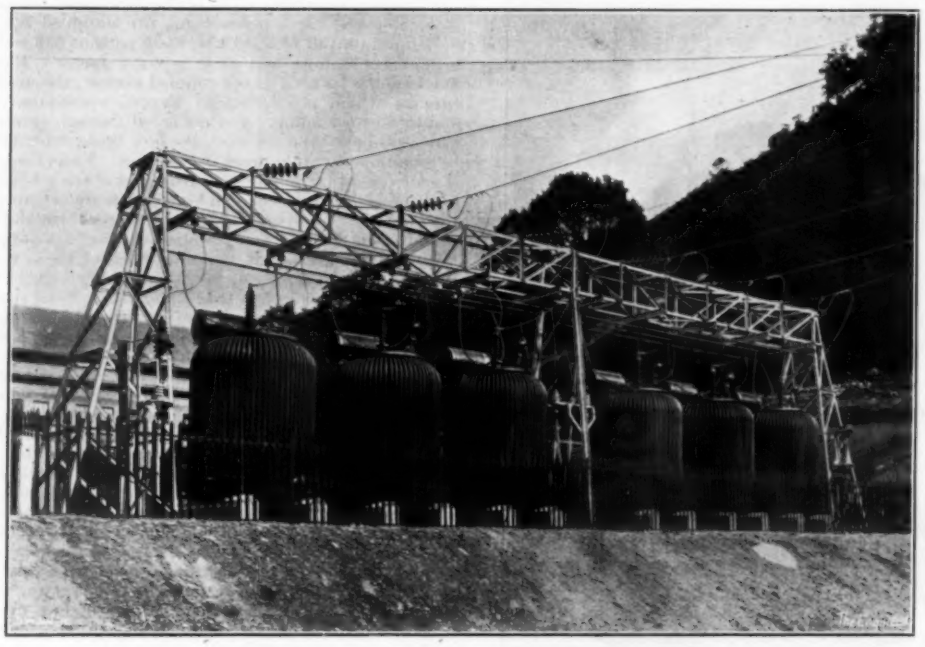
All circuit breakers are electrically operated by means of solenoids energised from separate control boards of the desk type, which are fitted with all the switches necessary for remote operation.

The transformers for stepping up the generated voltage to feeder pressure are of the outdoor pattern and are arranged in a compound adjoining the station building. There are two 3500 kVA three-phase units of ratio 6600/20,000/35,000 volts for use on interconnector feeders to Dolgarrog, Cwm Dyli and the Western Area feeders. Six single-phase transformers arranged in two banks of 10,000 kVA capacity with a transforming ratio of 6600/66,000 volts are provided to transmit power to the Wrexham and Crewe areas. The transformers are oil immersed and self-cooled, an interesting feature of the three-phase units being the use of special cable boxes, which permit of removal of the transformers without the cable joints being disturbed.

The site of the generating station has been excellently chosen. The water, from the fall of which, to practically sea level, the electric energy is produced, is derived from a catchment area some 23 square miles in extent, which varies in altitude from 650ft. to

2800ft. above Ordnance Datum. The area is well placed geographically from the point of view of rainfall. From the records of precipitation which are available it would appear that the rainfall varies from 70in. to 110in. per annum, which represents an output of from 35 to 40 million units of electricity per annum. The area, moreover, is for the most part steeply sloping and rocky, and in view of the facts that the rainfall is as heavy as we have indicated and that it is practically continuously distributed throughout the year, a high percentage run-off is obtained. The run-off originally drained into the Afon Prysor, and by the building of a dam across the valley of that stream and the construction of other dams, to which we shall refer in due course, a reservoir has been formed. This reservoir, when filled to its present top water level, is capable of impounding a useful storage of 1200 million cubic feet, or nearly 7,500,000,000 gallons of water. That capacity is sufficient for the continuous operation of the power-house, even in years of minimum rainfall. Moreover, it is anticipated that, in future, leets, which will enable the drainage from other catchment areas to be drained into the reservoir or lake, may be constructed and that the top water level of 652·25 O.D. will then be raised by increasing the heights of the dams, which have all of them been designed with that possibility in view.

Some idea of the extent of the reservoir may be gathered from the fact that, when it is full, the water surface will measure roughly 3 miles long by some 1½ miles wide. For its construction it was, of course, necessary to purchase the land which it submerges, with the buildings on it, and also to divert the main road running from Dolgelly to Festiniog, just north



10,000 kVA., 6600/66,000 Volt Transformer Banks

of the village of Trawsfynydd, as well as another road and various footpaths. It was also necessary to raise the height of the road to the southward of Trawsfynydd so as to bring it above top water level in the reservoir.

The configuration of the land was such as to render the construction of a reservoir comparatively easy from an engineering point of view ; but, in addition to the dam across the river—the Maentwrog, or main dam as we shall call it—it was necessary, as has been said, to build three other dams across depressions in the land to act as cut-off walls. These dams, though not of such height as the main dam, are nevertheless structures of no inconsiderable magnitude. Perhaps it would be best to describe them before proceeding to discuss the remainder of the works. The drawing on page 430, which shows a general plan of the works and various details, indicates the positions of the four dams. There is first of all the Maentwrog, or main dam, at the north-west corner. Then, close together to the north-eastward are the Gyfynys Dam and the Hendre'r-Mur Dam, while to the south there is what is known as the Trawsfynydd Dam. All the three last-mentioned dams, though they vary in length, are practically of the same cross section and construction. They are founded on rock and are of mass construction of gravity type, without spillways. In all cases the interiors are formed of 6 to 1 concrete, while there is an 18in. face of 4 to 1 concrete on the water side, which is vertical. The outer face, which, as will be seen from the small cross sections is stepped in view of the possibility of raising the height in the future, has a slope of 7 to 10. Each dam has a footway across it at a height of 1ft. 9in. above top water level in the reservoir, while on the water side of the footway there is, in each case, a wave wall taken up 4ft. above the footway level. The Gyfynys Dam, which is 1133ft. long, has a maximum height above ground level of 40ft., while the Hendre'r-Mur Dam, which is 740ft. long, has a maximum height of 19ft. above ground level and 70ft. above the lowest foundation level. The Trawsfynydd Dam, which is formed of two concrete portions separated by an earth embankment, has a total length of 3000ft. and the maximum heights of the concrete portions are 20ft. and 14ft. respectively above ground level and 51ft. and 48ft. above the lowest foundation level. The western concrete portion of this dam is prolonged by an earth embankment.

All these three dams were more or less straightforward engineering works which need no particular comment. The main dam, however, is an entirely different type of structure, which called for considerable skill in its design and construction. As we propose to deal with it in detail in a following article we shall only here refer to it cursorily. As will be seen from the developed longitudinal section along the face and from the plan, which are given in the engraving on page 430, the dam is really composed of three separate structures, which, however, all combine to dam the valley. There is first of all the cut-off wall seen to the left in the drawing, then there is the dam proper, which is of arched form for the major portion of its length and has a straight wing wall at the right-hand side, and finally there is a further small structure which is formed across a depression in the ground further to the right. The larger part of the arch portion, the whole of the right-hand wing wall, and part of the small structure just mentioned are formed with spillways. Upstream and downstream views of the arched portion of this dam are given on page 434.

The present maximum top water level of the reservoir is at an altitude of 652·25ft. above O.D., the level of the spillways being 650ft. O.D. How steep the slopes of the sides of the reservoir are in some places may be realised from an examination of the drawing, in which three contour lines showing top water levels of + 650ft., + 660ft., and + 670ft., are given. Even, therefore, when, as it is proposed to do some time in the future, the top water level is raised to + 670ft. O.D., the surface area of the reservoir will not be very greatly increased.

The water is led away from the reservoir in pipe lines and tunnels, which will be referred to more specifically in a later article, to the power-house at Maentwrog and is discharged again into the Afon Prysor just before it forms junction with the Afon Dwyryd, but a short distance from where the latter enters the estuary, the Traeth Bach. The floor level of the power-house is only 22ft. above sea level, and with the reservoir full there will be a maximum static head of some 630ft. of water on the turbines. The invert of the outlet pipe from the reservoir stands about 47ft. 3in. below top water level, and during dry periods the reservoir may be drawn down to a water level of 620ft. O.D., so that the available effective working head will be in the neighbourhood of 600ft., which represents a pressure of some 260 lb. per square inch.

(To be continued.)

Steel Sections.—We have received from Fleming Brothers, of 65, Bath-street, Glasgow, a copy of their little pocket-book giving particulars of a great variety of steel sections, such as joists, channels, angles, girders, &c., which for its size contains a great fund of information. The book scarcely measures 5in. by 3¼in., and includes some 200 pages, and each page contains from one to one and a-half dozen lines of type. The matter is easily readable, and includes such information as the weight, safe load, area, moment of inertia, modulus of section, and deflection coefficient of the majority of standard sections rolled.

The Quarter's Shipbuilding Returns.

From the statistics issued by Lloyd's Register of Shipping regarding vessels under construction at the end of September, it appears in Great Britain and Ireland there was a reduction of 112,850 tons in the work in hand, as compared with the figures for last June, and that the total—1,089,760 tons—was also 446,656 tons lower than the tonnage being built at the end of September, 1927. As compared with that date, there was on the Clyde a reduction of 27·7 per cent., while on the North-East Coast the decrease represented no less than 47 per cent. From a diagram issued with these returns—which shows the tonnage being built in this country at the end of each quarter since 1882—it can be seen that the average tonnage under construction during the last six years—December, 1922, to September, 1928—only amounted to about 1,230,000 tons, as compared with an average of over 2,000,000 tons for 1913, the record pre-war year. It may be of interest to state that about 151,000 tons of the tonnage now being built in this country are intended for the British Dominions and about 149,000 tons are for sale or for foreign shipowners.

The tonnage under construction abroad—1,431,582 tons—was 26,270 tons lower than the work which was in hand at the end of June, but exceeded by 342,000 tons the tonnage now being built in Great Britain and Ireland, while at the end of December, 1927, the tonnage being built abroad was about 40,000 tons less than the total for this country. Four countries abroad had more than 130,000 tons under construction, viz. :—Germany, 423,375 tons ; Holland, 191,290 tons ; France, 138,362 tons ; and Italy, 132,739 tons. The total tonnage under construction in the world amounted to 2,521,342 tons, of which 43·2 per cent. was being built in Great Britain and Ireland and 56·8 per cent. abroad ; while the average percentages in the last twelve months before the war were 57·2 for Great Britain and Ireland and 42·8 for abroad. In Great Britain and Ireland 244,591 tons were commenced and 387,572 tons were launched. Similar figures for abroad are 252,989 tons commenced and 443,927 tons launched. It will be seen that the tonnage launched in the world considerably exceeds the tonnage commenced during the same period.

A further reduction is shown in the tanker tonnage under construction as compared with the very high figures reached during 1927. The present figures are 61 vessels of 416,787 tons, of which 166,550 tons are being built in Great Britain and Ireland, and 72,632 tons in France. While in Great Britain and Ireland the tonnage of motorships under construction—497,598 tons—is still less than the tonnage of steamers being built, the motorship tonnage being built abroad reaches 922,004 tons, as compared with 496,283 tons of steamers. The world figures for motorships actually exceed by 335,000 tons the total for steam tonnage. The striking progress of the internal-combustion engine is also indicated by the fact that while there are now being built in the world 63 motorships, each of 8000 tons and upwards, only 21 steamers of such size are under construction.

The table respecting marine engines unfortunately does not show complete world figures for marine engines of all types, as the figures for steam turbine engines being built in Germany are not available ; but the table shows that the indicated horse-power of the reciprocating engines now being built or being fitted on board amounts to 414,000 horse-power, while the figures for oil engines reach over 1,280,000 horse-power.

The tonnage being built throughout the world under the inspection of Lloyd's Register now reaches 1,574,413 tons, of which 921,179 tons are being built in Great Britain and Ireland.

LIFE OF JAMES BEAUMONT NEILSON, F.R.S.

Desiring to celebrate the centenary of the introduction of the hot-blast, the Council of the West of Scotland Iron and Steel Institute, decided to prepare and publish a short life of the inventor, Mr. J. B. Neilson. The task of compilation of all the facts that could be found was entrusted to Mr. Thomas B. Mackensie, M.I. Mech. E., who has produced an excellent brochure. It has as a frontispiece a portrait of Neilson, reproduced from a painting in the possession of the family. Neilson was born at Shettleston, three miles from Glasgow, in June, 1792, his father being for a time one of Dr. Roebuck's workmen. He received quite a simple education, and left school when he was fourteen, and worked at Govan Colliery. At sixteen years of age he was apprenticed as a mechanic to his brother. In 1814 he got a job as engineer of a colliery, and a few years later was selected as engineer to the Glasgow Gasworks, at a salary of £90 a year which rose subsequently to £400. It was during this period that he first began to consider the problems of iron smelting, and it is interesting to note that he foresaw at that early date the advantages of drying the air for blast-furnaces. It was in 1828 that he secured a patent for heating the air. He said himself some years later that the invention consisted solely in the principle of heating the blast between the engine and the furnace, and was not associated with any particular construction of the intermediate heating apparatus. He seems to have struck upon the principle by pure accident, being consulted with regard to the supply of air to a blast-furnace situated half a-mile from the blowing engine, and it occurred to him that he could increase the *volume* of the air by heating it and so make the furnaces more efficient. He made a few simple experiments and found that the hot-blast increased the temperature of combustion. This is an illuminating case of a false idea leading to a valuable conclusion. The increase of the volume of the air could have had no useful effect ; the increase of its temperature had. Neilson employed various forms of stoves for heating the air, and the fuel consumed by them naturally ran away with the thermal efficiency though the advantages of the higher temperature remained. It was not until 1860 that the regenerative system invented by E. A. Cowper made the hot-blast both thermally and chemically efficienct.

Railway Matters.

In view of the present agitation arising out of the Charfield railway accident, for the elimination of gas as an illuminant of railway carriages, it may be noted that the Railway Returns for the years 1924–1927 show that out of a total of 5576 new or rebuilt carriages, 5551 have been provided with electric lighting.

The position of assistant engineer, new works, North-Eastern areas London and North-Eastern Railway, became vacant last April by the retirement of Mr. J. Triffitt. That post has now been filled by Mr. H. J. Rudgard, assistant engineer, maintenance, taking over Mr. Trifiitt's duties in addition to his own.

Road motor transport has so reduced the traffic on the Great Western Company's Plymstock and Yealmpton branch, that unless conditions improve, the railway is likely to be closed. The line is single, 6¼ miles long, and runs from a junction with the Southern Company's Plymouth and Twinchapel branch at Plympstock to Steer Point on the Yealm Estuary.

The Southern Railway has just put into service 100 new insulated containers designed specially for the meat traffic between Southampton and London. They are lowered into the hold of the vessel in dock, loaded with meat from cold storage, and then transported direct to London by train to Nine Elms, where they are transferred to lorries and taken straight to Smithfield Market.

In our Seven-day Journal on April 27th last mention was made of the strengthening of the approach spans of the Royal Albert Bridge over the Tamar at Saltash. It was noted that the work had been begun on the eastern or Plymouth side, and we remarked that it was most likely that work would be started on the western or Saltash side next spring. We now hear that the contract has been let for strengthening the latter eight spans.

Three new railways are projected for North Manchuria. The first is 540 *li* long, from Tungping to Misham, passing Fangcheng, Muling, and Poli. Construction will take two years and the cost is estimated at 25,000,000 dollars. The second starts from Hailin, a station on the Chinese Eastern Railway, and terminates at Tungkingcheng, a distance of 150 *li*. Work has already been started, the capital of 1,500,000 dollars being jointly supplied by the people of Hailin and Tungkingcheng. Construction will take one and a-half years. As the completion of this line will greatly increase its business, the Chinese Eastern Railway has consented to supply materials and rails at a very low cost. The third railway is entirely financed by the people of Keilungkiang Province, and is the 250 *li* line from Tsitsihar to Koshan, estimated to cost 5,000,000 dollars. There will be twelve stations each 21 *li* apart. Construction will take about two years. (One *li* = ½ mile. One dollar = about 2s.).

The Ministry of Transport railway statistics for July have recently been issued as a Stationery Office publication, price 3s. 6d. In comparing the present figures with the corresponding figures for July, 1927, it must be remembered that the latter period would include a very large proportion of the August Bank Holiday traffic, as that event fell on August 1st last year and not until August 6th this year. The total number of passenger journeys was 2·6 per cent. less than in July, 1927. Ordinary passengers decreased by 12·8 per cent., but despite the Bank Holiday in 1927, passengers at cheap fares increased by 6·5 per cent., and workmen by 7·8 per cent. Passenger fares then were down by 11·9 per cent.; mileage, though, was increased by 2·6 per cent. Freight tonnage fell by 9·1 per cent., of which general merchandise decreased by 6·4 per cent. and coal and coke by 10·6 per cent. Freight receipts fell by 8·3 per cent., of which general merchandise was 4·8 per cent., and coal and coke 15·3 per cent. Freight train mileage was reduced by 5·8 per cent.

In addition to the serious railway disaster on Saturday morning last at Charfield, as to which there is a reference in our Seven-day Journal, there were two other fatal passenger train accidents last week. Late on Tuesday evening a colliers' train met, in head-on collision, a passenger train at New Tredegar Colliery, on the Rhymney section of the Great Western Railway, and one passenger was killed. Incidentally, that was the first fatal passenger train accident on the Great Western Railway since that at Warminster on September 2nd, 1916. The other collision last week occurred on Friday evening, just outside Queen-street Station, Glasgow, London and North-Eastern Railway. The first portion of the 9.45 p.m. train for Edinburgh and King's Cross came to an unexpected stand outside the station, and, for reasons that have not yet been made public, it was run into by a train that was being shunted out in order to be put into the just vacated platform to form the 10.2 p.m. to Alloa. Two passengers were killed in that accident, and that brought the number of passengers killed in train accidents this year, exclusive of those at Charfield, to thirty-one.

The Board of Trade returns show that the value of the railway material exported during the first eight months of the present year was as follows, the corresponding figures for 1927 and 1926 being added in brackets:—Locomotives, £2,436,965 (£1,225,891, £2,434,950); rails, £2,430,553 (£1,909,684, £1,236,702); carriages £1,915,084 (£2,243,354, £1,970,219); wagons, £2,271,527 (£1,710,915, £2,201,598); wheels and axles, £597,188 (£441,216, £356,135); tires and axles, £401,158 (£390,118, £207,980); chairs and metal sleepers, £656,231 (£900,075, £602,094); miscellaneous permanent way, £957,455 (£1,024,514, £785,157); total permanent way, £5,126,520 (£4,849,446, £3,325,110). The weight of the rails exported was 280,679 tons (232,654 tons, 156,438 tons); and of the chairs and metal sleepers, 66,000 tons (90,591 tons, 62,254 tons). During the month of August last the value of the locomotives shipped overseas was £217,099, which included:—India, £77,629; Ceylon, £35,480; the Argentine, £21,390; other countries than the Argentine, in South America, £9450; Australia, £2138; Straits Settlements, £1800. The value of the rails shipped during August was £271,518, which included:—The Argentine, £51,106; British West Africa £35,189; South Africa, £10,486; Australia, £4518; and Portuguese East Africa, £3097.

Notes and Memoranda.

Arrangements are now being made for direct telephonic communication between Montreal and Vancouver over Canadian territory throughout.

In the October issue of *Vulcan* there is an article full of the reminiscences of one of the insurance company's inspectors, which contains some useful hints for the younger generation of engineers. Among them we will mention only one example. The load having been taken off a steam engine it began to race, as the governor was defective. Attempts were made to close the stop valve, but it was found to be jammed hard open. It was, however, ultimately released with the help of a pinch bar, and an accident was averted. The moral is, of course, although it is not mentioned by the author, that after a valve has been fully opened, it should be screwed back a fraction of a turn so as to leave the spindle free in the nut.

The recent development and growing use of soap powders and flakes have led to a new industrial hazard. Tests made at the Pittsburg Experiment Station of the United States Bureau of Mines, Department of Commerce, have shown that certain types of soap-dusts when suspended in air are more violently explosible than most dusts encountered in industry. The well-known "cooling" effect of sodium compounds on the flames of explosives and the "semi-inorganic" nature of the compound soap, might lead one to expect soap-dust suspensions to be relatively non-explosible. Soap-dust suspensions in air are, however, easily ignited and produce violent explosions accompanied by much flame and large quantities of heat.

During the six months ended June 30th last Canada produced 906,258 fine ounces of gold valued at 18,734,015 dollars, as compared with 863,031 fine ounces, worth 17,840,434 dollars for the corresponding period of 1927, an increase of approximately 5 per cent. During the first half of 1928 Canada produced 46,463,107 lb. of nickel worth 10,625,702 dollars, as compared with the corresponding 1927 total of 34,781,199 lb., valued at 8,008,823 dollars, an increase of 33·6 per cent. in quantity and of 32·7 per cent. in value. The total production was made up of 19,589,969 lb. of nickel in matte and speiss exported; 21,955,829 lb. representing refined and electrolytic nickel produced in Canada; and 4,917,309 lb. of nickel in oxides and salts sold.

There is in force in Mozambique a law by which, according to the *South African Mining and Engineering Journal*, new industries are fostered—that of giving exclusive right for the manufacture of the products of the soil, or what is termed "raw material," with a limited amount of imported matter not found in the colony. Such law gives the successful applicant ten years' exclusive right, and at the end of that period, provided nothing has been done contrary to the interests of the concession, another term of ten years is given. In considering such application nationality does not count. The proposals are carefully examined, and the one which is best adapted for dealing with the raw material of the Colony is accepted and sent to the Government Council for approval.

Lithopone consists theoretically of 29·5 per cent. zinc sulphide and 70·5 per cent. barium sulphate. It is made by mixing solutions of zinc sulphate and barium sulphide in molecular proportions. The precipitate formed as the result of this reaction has no body or hiding power. It requires exceedingly careful manipulation and treatment for conversion into a suitable pigment. After washing, drying and ignition to dull redness, followed by sudden quenching in water and grinding in its pulp state, washing and drying again, it makes an excellent paint pigment. It is brilliant white in colour, exceedingly fine in texture, and has excellent hiding power. When compared with pure zinc oxide, it is shown to have greater hiding power. Lithopone is stable in every medium known and used for paint purposes, excepting those which are highly acid.

A paper on an investigation into the catalysts used in the synthesis of higher hydrocarbons from water gas, was recently contributed to the Society of Chemical Industry. In their summary the authors say:—"Comparing the experiments carried out with different plain catalysts of 285 deg. and with a gas mixture containing equal parts of carbon monoxide and hydrogen, the cobalt-copper-zinc oxide catalyst appears to be the most suitable. After the initial period its activity was fairly constant, causing a contraction of about 50 per cent. for several days. Nearly as constant as this was the cobalt-copper-aluminium oxide catalyst, but less oil and more water was formed in its presence. The oil yield was the highest with the non-promoted cobalt-copper catalyst, the activity of which, however, decreased most rapidly. The cobalt-copper-cerium oxide catalyst produced the smallest yield of water and a fairly good yield of oil, but although the contraction in the initial period was the highest in the presence of this catalyst, its activity decreased nearly as rapidly as that of the non-promoted catalyst.

Twelve major topics for discussion at the second International Conference on Bituminous Coal, to be held under the auspices of the Carnegie Institute of Technology, Pittsburgh, Pa., on November 19th to 24th, are tentatively announced by Dr. Thomas S. Baker, President of the Institute, and Chairman of the Congress. Although the Conference will be similar in purpose to the first Congress held in 1926, its scope has, says *Nature*, been considerably enlarged and the programme is more international in character. The discussion on fixed nitrogen will no doubt arouse considerable interest. The liquefaction of coal, which was one of the principal subjects of discussion at the first meeting, will again occupy a prominent place in the deliberations. Low-temperature distillation will be treated by representatives of at least a half-dozen countries. High-temperature distillation, power from coal, coal tars, and oils, complete gasification of coal, origin of coal, coal washing, pulverised coal, catalysts, and the general aspects of the bituminous coal industry are other topics that will be considered. Representatives from England include Lord Melchett, Dr. C. H. Lander, Mr. Harald Nielsen, Colonel Lindemann, Dr. R. Lessing, and Mr. Edgar C. Evans; France, Germany, Italy, Austria, Belgium, Denmark, Poland, Russia, Japan, Czecho-Slovakia, Canada, Norway, Spain, Chile, Rumania, Jugo-Slavia, and Bulgaria will also send delegates.

Miscellanea.

It is proposed to put up a lead smelting works at Brough, near Hull.

The sugar beet crop of Alberta is estimated to be 20 per cent. in excess of that of last year.

A plant for the concentration of zinc-lead ores is to be put up at Sterling, in the Richmond County of Nova Scotia.

During the past five years nineteen all-concrete roads have been laid in Cardiff, the total area being 66,396 super yards, representing a length of 3·9 miles.

It is noteworthy that as much as 10,000 kW is now being transmitted from Gatineau to Toronto at a pressure of 220,000 volts. The distance is 226 miles.

Work has been started on the construction of the hydro-electric plant at Seven Sisters Falls, Winnipeg, which is to have an ultimate capacity of 225,000 horse-power.

A large factory for the production of photographic film is to be put up at Harrow by the Kodak Company. Hitherto most of the film required by the company has been imported.

A company, with a capital of £25,000, has been formed in Auckland, New Zealand, for the development of the mercury deposits near Nghwha Springs between Ohaewai and Kaikaha.

One of the latest factories to be inaugurated in Capetown, South Africa, is one in which all classes of white metal, which were previously imported, are produced. The new works include a zinc smelting department.

According to the *Statesman* a scheme is in contemplation in Assam by private enterprise for the formation of a company for the purpose of building and working a rope-way for the conveyance of goods and animals between Cherrapunji, Bholaganj and Chhatak. The cost of the scheme is estimated at some £25,000.

A Dutch scientist claims, says the *Chemical Trade Journal*, to have obtained chemically pure carbon by the catalytic decomposition of carbon monoxide by means of iron oxide at temperatures of 700 deg. to 800 deg. Cent. The material obtained is free from ash and iron and its specific gravity is 0·2. It has been designated "Alpha" carbon and has been suggested as a lubricant and as a fuel for motors.

An unusual form of "scow" is in service at Seattle for dumping spoil out at sea. It is symmetrical about a horizontal plane and can accommodate its load whichever side is uppermost. Buoyancy is provided by side compartments, and by a system of flooding these compartments the scow can be turned completely upside down to dump its load. A new load is then placed on the side uppermost and the process is repeated.

The fifth of the six destroyers which John I. Thornycroft and Co., Ltd., are building for the Chilean Navy was launched on Tuesday last, October 16th, and named the "Videla." The new Chilean destroyers are all named after the heroes of the Battle of Iquique. Videla was the Surgeon of the "Esmeralda" and went down with his ship, when she was at last sunk by the much more powerful Peruvian monitor "Huascar." The name "Videla" was carried by a previous Chilean war vessel. This was a first-class torpedo boat built in England in 1895. This earlier "Videla" was one of the last torpedo-boats to be built.

The Argentine Ministry of Public Works has authorised the Director-General of Navigation and Ports to proceed forthwith with the construction of five additional pier docks in the northern outer port of Buenos Aires, the estimated cost, including electrically operated cranes, being 6,186,000 pesos paper—about £525,000. The great increase in import and export trade has rendered additional harbour facilities necessary, especially berthing quays for the more rapid handling of wheat. Before work can be commenced on the first unit, which is estimated to cost about £104,000, the estimates must be passed by both Houses of National Congress; but, in view of the strong recommendations of the committees, their passage is anticipated.

Fire on September 17th destroyed the creosoted timber decking on the two eastern spans of the combined railway and highway Harahan Bridge at Memphis. The fire burned the entire cantilever span and well into the Tennessee anchor span as well as two panels at the east end of the long fixed span. The floor beams, stringers and roadway brackets over the entire burned area are a total loss. The main bottom chords, four-rib members built up of eight 8in. by 8in. by 1in. angles and four 42in. by 1 ⅛ in. webs with top and bottom angle lacing were damaged in three places. However, as only one of the webs of each chord was damaged, it is believed, says *Engineering News-Record*, that replacement can be made without dismantling the chords.

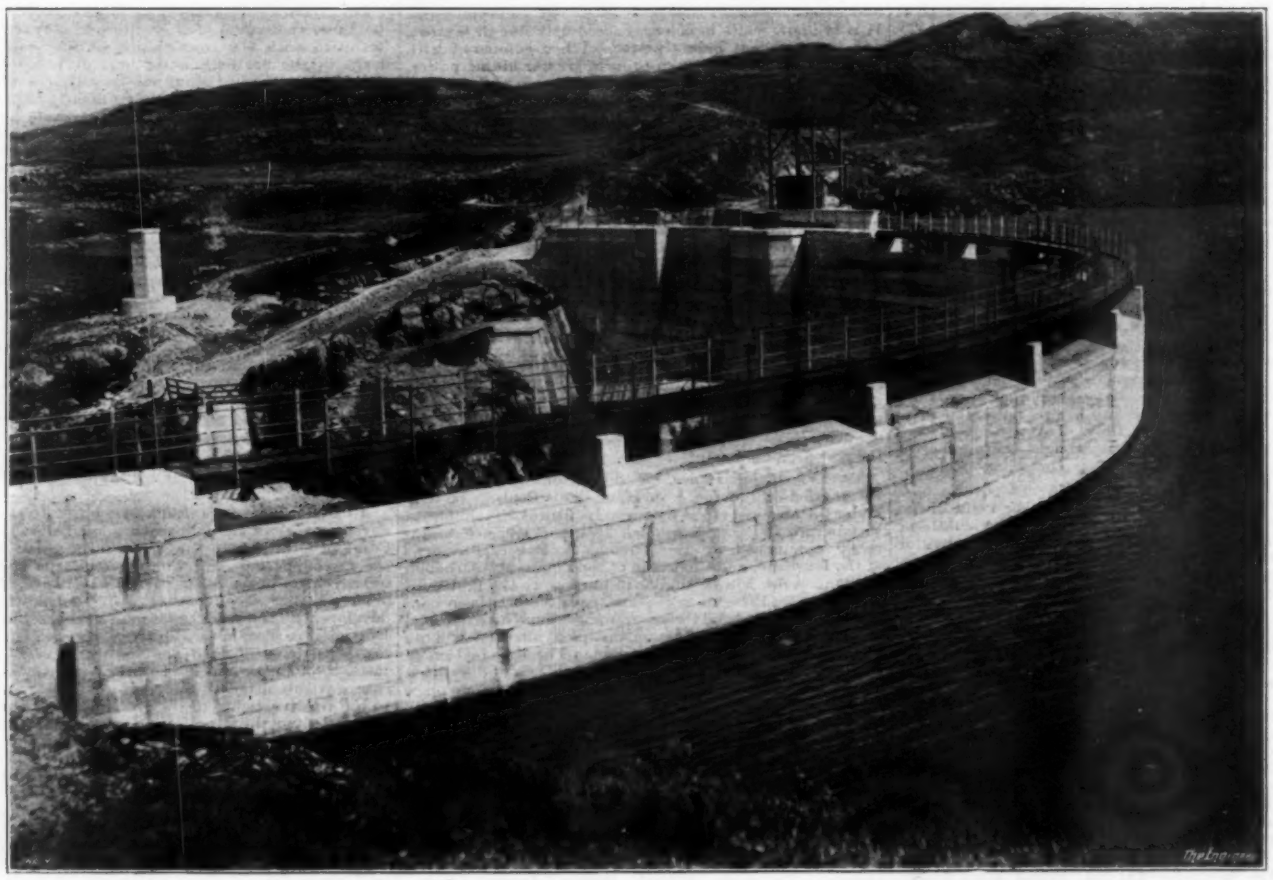
A case of great importance in relation to the industrial development of Canada recently came before the Supreme Court of Ottawa. In the course of negotiations between the Canadian and American Governments regarding the improvement of the St. Lawrence waterways, the question arose whether the extensive water powers likely to be developed by the work came under the jurisdiction of the Dominion or Provincial Governments, and further action has been delayed until the matter is settled. At the instance of the provinces of Ontario and Quebec, a stated case was submitted to the court asking for a decision as to the relative rights of the Dominion and the Provinces in relation to the proprietory interest in, and executive control over, water powers created or made available by works for the improvement of navigation. These water powers on the St. Lawrence, Ottawa, and other navigable rivers are estimated to be worth hundreds of millions of dollars. The amount of power capable of being generated by the St. Lawrence alone is estimated at 4,000,000 H.P. With the increasing demand for power, and the exhaustion of other sources of supply, there is a keen desire in industrial circles for a prompt settlement of the question, so that many projects for power generation now necessarily held in abeyance can be proceeded with.

THE MAENTWROG HYDRO-ELECTRIC POWER STATION

MESSRS. SIR DOUGLAS FOX AND PARTNERS, WESTMINSTER, ENGINEERS

(*For description see page 431*)

DOWNSTREAM FACE OF MAIN DAM—ARCHED PORTION



UPSTREAM FACE OF MAIN DAM—ARCHED PORTION

The Engineer

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THE ENGINEER.

OCTOBER 19, 1928.

The Limitation of Road Traffic.

THERE are many prophets in the land who seek to make our flesh creep by pictures of what our roads and highways will be like after a few more years of intensive production on the part of the motor car factories. The total number of motor vehicles in use in the country is admittedly increasing at a very pronounced rate. All classes included, the increase has been maintained at about 200,000 per year for the past seven or eight years. Since 1919 the grand total has increased from 271,000 to 1,865,000 in 1927. Excluding the motor cyclists, of whom there are now 681,000, the private motor car owners, numbering 787,000, dominate the situation. In 1911 there was one private car to 870 people in this country. Last year there was one to every 56 people. In this respect we are in a happier position than the United States, where every sixth person in her immense population owns a car. Italy, on the other hand, is in the relatively blissful condition of having but one private car to every 353 of her population. Already, as we know, the Ministry of Transport and other authorities affected by the problem are seriously concerned about the rapid growth in the number of mechanical vehicles using the roads, and with each year are finding it more and more difficult to provide the road room which is so stridently demanded. The construction of arterial and by-pass roads, the building, widening and strengthening of bridges, and the carrying out of other works of relief already lags behind the needs of the expanding volume of road traffic. Is there any limit in sight to the expansion of that traffic or are we to believe with the prophets that we are shortly to witness a state of road congestion of a staggering order ?

The Society of Motor Manufacturers and Traders has recently issued a small book packed with information, interesting and curious, concerning Great Britain's motor industry. The facts and figures presented in this book place us in a position to discuss intelligently whether there is any limit to the growth of road traffic congestion, and, if so, whether it is now within sight. If we are to believe the evidence provided by the statistics in the book not only is there such a limit, but it is within sight, and indeed imminent. There has been a considerable amount of discussion recently in legal and journalistic circles concerning the minimum income which a man should possess before he is justified in owning a car. According to a certain learned judge, the minimum income required is £1500. On that basis more than two-thirds of the private car owners in this country at the present moment are open to censure. Even if we allow everyone having an income exceeding £2000 a year to own two cars, there ought, according to this judicial dictum and the official returns of incomes, to be only 233,100 private cars in use in Great Britain. The Society of Motor Manufacturers and Traders takes a more modest view than our judge of the minimum income which justifies the ownership of a private car. It places it at £400 a year. Taking this as the basis figure, it estimates from returns showing the distribution of incomes that the total number of "potential" owners of cars in this country—counting twice those with incomes exceeding £2000—is about 950,000, or possibly 1,000,000 Last year, as we have already said, there were 787,000 private cars in use. This year's figure, it is estimated, will reach 900,000. The inference seems plain ; the home motor car market is rapidly approaching the point of saturation, the point at which sales will merely replace the cars scrapped or wrecked and will not add to the number actually using the roads. This conclusion may prove consolatory to those who anticipate with terror the further congestion of motor traffic on our highways. We, however, find it neither consolatory nor convincing. We have grave doubts as to whether the method employed for arriving at the saturation limit is justified. The example of the United States is before us. Why should the limit in Great Britain be reached at a density of one car for every fifty or so people while in America the limit has admittedly not yet been reached with a density of one car to every five or six persons ? It cannot be that in the States the number of people with incomes above the car-owning limit is ten times as great relatively to the size of the population as the number in Great Britain. Increased prosperity on the other side of the Atlantic may explain a part of the difference, but it would be absurd to suppose that it could explain it all. Nor can we believe that the vast extension of the hire-purchase system in the United States can likewise do more than explain a portion of the discrepancy. The purchase price of a car, outside the expensive luxury models, is nowadays almost a minor consideration. The annual bill to be met out of income is almost wholly determined by maintenance and running costs, taxation, insurance and garage charges ; that is to say, by factors which cannot be brought within the scope of the hire-purchase system. Some slight part of the difference between the two countries may perhaps be accounted for by the cheaper charges for petrol enjoyed by the American motorist, but against that economy we may set the extra costs for repairs and upkeep which he has to meet and the fact that the average life of his car is estimated at seven years, as compared with eleven for a British car. The taxation factor would appear to be the principal probable cause of any difference which may really exist between the two countries in the matter of car ownership ; but even with all the others added it seems to be far from sufficient to account for the suggested ten to one ratio. Instead of having 787,000 private cars, as in 1927, this country, had the American density figure been applicable to it, would have had 7¼ million odd. In other words, there are about 6¾ million fewer private cars in this country than there might be on the American basis. To explain the absence of these cars from our roads is a formidable task, which we do not propose to attempt. It is very evident, however, that this comparison of the actual state with what it might be provides strong grounds for doubting the soundness of an estimate which places the saturation limit at about one million cars. That estimate, based as it is on the distribution of income figures, seems at first sight to be thoroughly logical and almost unassailable. We are satisfied, however, that it overlooks several important factors which might easily raise the saturation limit far above the figure of one million. It neglects, for instance, to make allowance for cars which, though registered as private, are paid for and maintained, wholly or in part, by business firms for the use of their

staffs. There is probably room for a considerable expansion in the number of such business cars, while all those at present in use are, in the estimate, counted as if they were owned by individuals with incomes in excess of £400. Again, the estimate neglects the considerable number of second-hand cars in dealers' garages waiting sale, with their registration tax paid to the end of the year. The majority of these cars have probably been taken in part payment for new cars. So far as the estimate is concerned, each old and new car should be counted in satisfaction of one, not two car-owning incomes. Finally, we cannot doubt that, rightly or wrongly, there are in this country many car owners whose incomes are far less than £400 per year. We conclude, therefore, that there are more car-owning incomes still to be satisfied than the estimate allows, and that there are more opportunities for the sale of cars than the number of incomes in excess of £400 would indicate.

We are in some measure sorry to destroy any hopes founded on the Society of Motor Manufacturers' analysis that a definite limit is within sight to the expansion of motor traffic on our roads. That estimate, however, even though it were completely acceptable, would, we are afraid, encourage false hopes. It is concerned only with the use of the roads by private cars and bears in no way on the congestion caused by the increasing number of trade and public hire vehicles. It seems to be true that the bulk of the passenger traffic on our main roads—78·66 per cent., according to the Society's statistics—is accounted for by private cars and motor cycles. The apparently omnipresent charabanc accounts, it is said, for only about 4 per cent. of the passengers transported. Nevertheless, it is a fact of common observance that the congestion caused by vehicles of the charabanc type is quite out of keeping with the number on the roads and has nothing to do with the quantity of passengers which they happen to be carrying. Further, no one can fail to see distinct signs that charabanc transport is certain to increase enormously within the next year or so. Let us therefore disabuse our minds of any false suggestion of an immediate limit to the number of vehicles using the roads. Under present conditions the only limiting factor likely to make itself felt is the congestion itself. Such congestion as we have experienced during the past summer is likely to prove much more effective and much more immediate in stopping the growth of road traffic than any considerations based on financial expediency and the distribution of incomes.

The Education of Salesmen.

It is, surely, one of the most remarkable results of the so-called "industrial revolution" that the foundations upon which industries rest have shifted from the purchaser to the manufacturer. It is no longer the demand that makes the industry, but the industry that makes the demand. We may imagine that in a perfectly balanced community the forcing of sales would be unknown. The purchaser would buy what he wanted when he wanted it and could afford it; the manufacturer would make just what was sufficient to meet the demand. We can still see that method in action in some cases. No one builds large ships or large locomotives, large houses, or large bridges in advance of the demand for them; they are made just as and when required. But the modern industrial world as a whole could not continue for long on that plan. It cannot afford to wait for a demand; it must provoke it by propaganda, by advertisement, by clever salesmanship. It must encourage people to develop new wants; it must nourish discontent with present possessions; it must stimulate the "cultivation of new tastes and the appreciation of new comforts." If the process were not continually going on unemployment would mount up to three and four times its present figure. We buy nowadays, we are forced to buy, many things that we could do without—things that our immediate forefathers lived quite happily without—not because we really need them but because if we do not buy them someone else will be left without the means of livelihood. Every employer of labour is impelled to force sales, not alone out of consideration of his own pockets, but because he sees a great body of workpeople dependent upon his exertions, and he knows that many shareholders rely, possibly for their only means of existence, on his success in selling his products. Furthermore, his market cannot remain stationary. He must enlarge it, because one way, a very important way, of reducing price is to increase output. So he is, ultimately, forced by circumstances, to go outside the natural field of his labours and seek to encourage, even amongst savage tribes, a demand for the goods he can supply. The Islanders of Rumtifoo must be westernised, not so much for the increase of their contentment, but because the manufacturers in industrial nations require new outlets for their products.

We are, as Mr. Garet Garrett pointed out some years ago, caught up by an inexorable machine. We must either whirl with it or be thrown off into the limbo of bankruptcy. We may protest against the tyranny; we may cry out to be left alone and not to be pestered to buy that and this; we may fulminate against blazing sky-signs and shake our fists at the postman for delivering circulars; we may deplore the lack of thrift which is encouraged by deferred payments and rail against the extravagance of the poor in the purchase of motor cars, pianos, gramophones, clothes, and a thousand other things. But all to no purpose. The industrial world lives upon extravagance and upon the fact that the luxuries of yesterday are the necessities of to-day. Its progress, nay its very existence, depends wholly upon its ability to make the world want something that it could do, and might even be better, without. The nation which is most capable in doing that is the most successful. Salesmanship which was at one time no more than the easy business of supplying people with what they asked for has become the art of making them want the thing that you are ready to supply. It is approaching the stage where it will be regarded as a science and for which special training will be available; in those days a Bachelor of Salesmanship will be more highly valued than a Bachelor of Arts or a Bachelor of Science. A committee to make a preliminary survey of the question is already in existence under the chairmanship of Mr. F. W. Goodenough, chairman of the Incorporated Sales Managers' Association, at whose banquet on Monday last Lord Eustace Percy, President of the Board of Education, was the principal guest. "The real and lasting cure for unemployment," said Mr. Goodenough, "was to be found in improved salesmanship, and the fundamental safeguard for British industry was efficient salesmanship backed up by efficient production and distribution." Lord Eustace said that the dinner marked the beginning of the inquiries into technical education which the Board of Education had undertaken. Two inquiries had been started, one into engineering education, the other into education for salesmanship, and the committee for the latter had already been formed. He held that it was peculiarly appropriate that it should be the first to get to work, for whilst the educational opportunities were already greater than was popularly supposed, "there was perhaps no branch of commerce and industry in which those opportunities were so miscellaneous or so little focussed by our schools into coherent courses of education."

We must await the publication of the reports of the Committee to see what useful suggestions it has to make with regard to the teaching of salesmanship, but even at this stage we may recall the changes which have taken place in the engineering industry, changes which we may possibly regard as indicative of those required by other industries. It is not so many years since the selling of machinery was left very largely in the hands of men who knew no more about the products of the firm they represented than could be learnt from a catalogue. We must, however, remember that they did know a great deal about the "market"; they were business men, but not engineers. Now a new class of salesman, if we may use what seems a petty word in this connection, is coming into existence. It is composed of men who have had, if not a complete, at least an adequate engineering training, and have superimposed upon it a training in commerce. Experience has shown that these men, through their ability to discuss technical problems, are more capable salesmen than those with little more than market knowledge. That, of course, is not a new discovery, but it is only of recent years that its full value has become appreciated. It is of particular interest to us because it opens out new fields for the surplus of young engineers. More are being trained than can secure full technical employment; but probably all can be absorbed by the industry if some enter deliberately, and not by chance, as now so often happens, the technico-commercial side and devote themselves to the art—and shall we say craft?—of selling. But before that can be fully attained, the last remains of the stigma which attaches to the bagman will have to go. Possibly, one of the most useful results of the new education of salesmen—the elevation of salesmanship to a science—will be the removal of that ill-deserved stigma and the entry of better educated men in greater numbers into the army of commercial travellers.

The Charfield Railway Disaster.

The unusually serious railway accident at Charfield on Saturday morning last, may be regarded not unjustly as reflecting on an article in our issue of June 8th in which we praised the safety of operation on British railways. Since that article was printed there had been, prior to the present unfortunate event, eight accidents in which loss of life occurred; of these three were derailments. Passengers were killed in the derailment of June 6th, at Swinderby, and in the collisions at Darlington on June 27th, London Bridge on July 9th, New Tredegar on October 9th, and Glasgow, Queen-street, on October 12th. Trainmen were killed in the derailment at Pinwherry on July 2nd, in the collision at Ancoats on July 29th, and when a road motor vehicle derailed an express at Shepreth on August 17th. In none of these cases, however, except at Darlington, did the fatalities exceed two, and in three instances only one person was killed—a passenger at Swinderby, a trainman at Shepreth, and a passenger at New Tredegar. On the top of these eight fatal accidents comes this serious disaster at Charfield. Even excluding that accident, the number of passengers killed in train accidents this year is higher than in any year since 1915, the year of the Quintinshill disaster. At first sight it might be thought that, compared with the Hull and Sevenoaks accidents of last year, our safety record is deteriorating, and that we are going back to the conditions of 1915 and of 1906—in the latter year fifty-nine passengers were killed in train accidents. Were such an assertion made, we would have, we admit, some difficulty in finding an excuse for the fact that six accidents have occurred to passenger trains this year, in which passengers have lost their lives, as only twice in the present century—in 1913 and 1915—have there been more than five. We cannot account for it. These events seem, however, to come in cycles. How otherwise can it be explained that whilst in the year 1915 there were eight fatal accidents and a death-roll of 269, including 224 at Quintinshill, there was only one accident during the next five years, in which more than one passenger was killed, except after a landslide, for which the railway was not responsible, at Little Salkeld, on January 19th, 1918? During the thirteen years since 1915 there have been thirty-five accidents in which passengers have lost their lives, but in eighteen—practically one-half—only one was killed, and in twenty-four altogether the deaths numbered three or less; twelve or more were killed in six cases.

Other countries present similar anomalies, of which the strangest comes from the United States. The number of passengers killed in train accidents there varied between 95 and 110 for the three years 1920–22, and was 54 and 41 respectively for 1923 and 1924. The total then rose to 83 for 1925, and 79 for 1926, and suddenly fell to ten in 1927. France, again, had an average of 28·4 passengers killed each year between 1904 and 1913, but the number was 76 in 1922, fell to 19 in 1923, and 24 in 1924, and rose to 46 in 1925. In Germany there were five serious accidents this year between June 10th and July 21st, of which three were fatal, resulting in the death of 24 passengers, 10 passengers and one passenger respectively. Considerable alarm was created, and Dr. Dapmüller, the chief of the headquarters administration of the Reichsbahn, issued a statement in which he said that advantage was always taken of railway accidents to raise all sorts of irrelevant and even imaginary complaints, which did no more than confuse the issue and possibly caused unnecessary anxiety on the part of the public. The statement concluded with the remark that on every railway, from time to time, a group of accidents attracted public attention, and led to extravagant assertions, which find no justification in the annual returns. If individual accidents reveal some departure from perfection it must be remembered that human fallibility can never be entirely eliminated. There are, on British railways, forty thousand drivers whose engines run 260 million miles a year, and who have to obey thirty thousand distant signal indications, and sixty thousand stop signals. Is it to be wondered at that those men occasionally make a slip? There are thirty thousand signalmen who are responsible for signalling and watching the train movements at twelve thousand signal-boxes. Yet in only four instances last year was an accident recorded as having been caused by

"the failure of signalmen to observe or give effect to regulations." All this is most remarkable and praiseworthy, and the results appear yet more splendid when there is remembered the frequency of trains, the constant succession of stations, junctions, and sidings, the closeness with which the signals follow each other, the speed at which the trains travel, and, often, the varying climatic conditions. Hence, despite this most regrettable accident, we have cause, we claim, still to be proud of the safety of British railways.

Round *versus* Square Transverse Bars for Grey Cast Iron.

By J. G. PEARCE, M.Sc. (Eng.).

THE most widely used test for the quality of cast iron is the transverse test, in which an end-supported bar of specified dimensions is fractured by a central breaking load, and the load and deflection at fracture observed. Standard bars of various sizes are employed, but hitherto they have always been rectangular. The ½in. square bar and 1in. square Admiralty bar at 12in. centres and the 2in. by 1in. at 36in. centres are commonly used, and others will be found in B.E.S.A. specifications. The specification invariably gives figures for minimum breaking load and deflection.

Many advantages would follow from the expression of transverse strength as a specific stress—*i.e.*, as a modulus of rupture—just as tensile and compression strengths are expressed in tons per square inch, rather than merely as a breaking load. This would bring British testing procedure into line with the invariable continental practice. The actual recording of results would be simplified, and the measurement of the area at fracture would be rendered essential. The present practice encourages disregard of differences, inevitable in ordinary commercial work on unmachined bars, between cast and specified sizes, and the load changes very rapidly with small changes in section, for in the case of rectangular bars it depends upon the square of the depth, and in round bars on the cube of the diameter. Another important advantage lies in the relationships which would be revealed between transverse strength and other specific stresses, such as tensile, compression, torsion, and shear, and between transverse strength and size of section. Thus the transverse strength is usually 1·8 to 2 times the tensile strength, a relation which is entirely obscured by the conventional method of expression, and hence not generally appreciated. The transverse strength also varies continuously with section, being, of course, least in the largest section, and this again is not realised, owing to the variety of sections for which recorded tests are available.

Objection has been raised to this procedure on the ground that engineers, assuming rupture modulus to be independent of section, might suppose a given modulus from a small bar to be equally obtainable from a large bar. No confusion, however, arises in the case of the tensile test, in which engineers appreciate fully that a large section will not give the same specific stress as a smaller section of the same metal, on account of the slower rate of cooling.

The main difficulty is purely arithmetical, the procedure necessary to work out rupture modulus being more complicated than that for tensile strength. For round bars, however, as specified in the new B.E.S.A. specification for two grades—A and C—of grey cast iron—No. 321, 1928—graphs can readily be prepared giving the rupture modulus under standard testing conditions for any breaking load over a range of diameters above and below the nominal size, covering an ordinary casting tolerance. The diagram shows a series of curves for the new 1·2in. and 2·2in. diameter standard bars for the permitted tolerances 1·1in. to 1·3in. and 2·1in. to 2·3in. respectively. The change of modulus with small variations in diameter for the same breaking load will be noted; also the change in load for the same modulus on the permitted variations in diameter. The minimum loads and rupture moduli for the two grades of metal are shown for each diameter. It will be seen that for an undersize bar the load and modulus demanded is slightly higher, on account of the extra strength arising from the more rapid cooling, and *vice versâ*. There is thus no temptation to cast undersize bars.

In the practical use of the diagram, to avoid arithmetical work, actual loads and diameters can be interpolated, and this is simplified if it is remembered that the lines of the diagram converge to the origin.

The expression of transverse strength as a specific stress is, of course, readily carried out by the ordinary beam formula for an end-supported, centrally loaded beam, the stress f or rupture modulus at fracture being $W L$, where W is the breaking load, L the distance between supports and Z the section modulus. The modulus of rupture of cast iron is not absolute, for the conditions under which the beam formulæ are valid are violated in the transverse test. It is peculiar to a given bar and depends upon distance between supports, diameter and composition.

Round and Square Bars.—The expression of transverse strengths as rupture moduli has emphasised an important difference between cylindrical and square bars of cast iron, the reason for which has hitherto been obscure. Founders have been aware for some time that, area for area, a transverse round bar is stronger than a square bar of the same metal. This has been attributed in the main to casting differences, for the mode of crystallisation of the two bars is different. The difference is not found on the tensile test, but here, of course, a substantial proportion of the cross section is machined away before the test can be made.

Some tests recently made by Dr. A. L. Norbury in the laboratories of the Cast Iron Research Association show clearly that the disparity is not due—at any rate in the main—to casting, but to testing conditions. Six square and six round bars of the same size were cast from the same cupola-melted grey iron. All the bars were skin-machined, and three of the round bars were then machined square and three of the square bars machined round. Transverse tests were then made. Of the six round bars tested, three originally had been cast round and three had been cast square. Of the six square bars, three originally had been cast square and three had been cast round. There was no systematic difference in strength between the machined-square and the cast-square bars, as such; or between the machined-round and the cast-round bars, the difference between both groups being 0·1 ton per square inch. There was, however, a marked difference between the specific strengths of the round and square bars. The round bars averaged 11 per cent. stronger than the square bars, irrespective of whether they were cast round or machined round from the square. The rupture modulus of the bars cast and tested round averaged 28·7 tons per square inch; that of the bars cast round and tested square averaged 25·5 tons per square inch. Conversely, the square bars were weaker than the round bars, irrespective of whether they were cast square or machined square from the round. The rupture modulus of the bars cast and tested square averaged 25·4 tons per square inch; that of the bars cast square and tested round averaged 28·6 tons per square inch.

Clearly the difference between the two shapes cannot be due to casting conditions, and must therefore be due to testing conditions. In particular, the differences between the actual and nominal section moduli for the two shapes cannot be the same. The result is of particular interest in view of the stress laid by foundry metallurgists and founders on the avoidance in cast iron designs of square corners and sudden changes in section.

The differences have been taken into consideration in fixing the breaking loads for cast iron bars in the new B.E.S.A. specification, referred to above, for the specified figures are based on actual tests. For the first time, this specification officially adopts the cylindrical bar as standard for grey iron, and there is evidence to show that in due course the round bar will supersede the present rectangular and square bars. In addition to the advantages referred to above, it is readily machined if a machined test bar is preferred.

The study of variation in strength of cast iron with section should be of great assistance to designers of cast iron structures, and this will be greatly facilitated by the general use of the round bar. The simplicity and effectiveness of the transverse test are such that the fullest value should be derived from it. This is obtained when the breaking load is expressed with due regard to the area at fracture as modulus of rupture. The advantages of this are many, and the extra complication involved due to calculation is readily overcome.

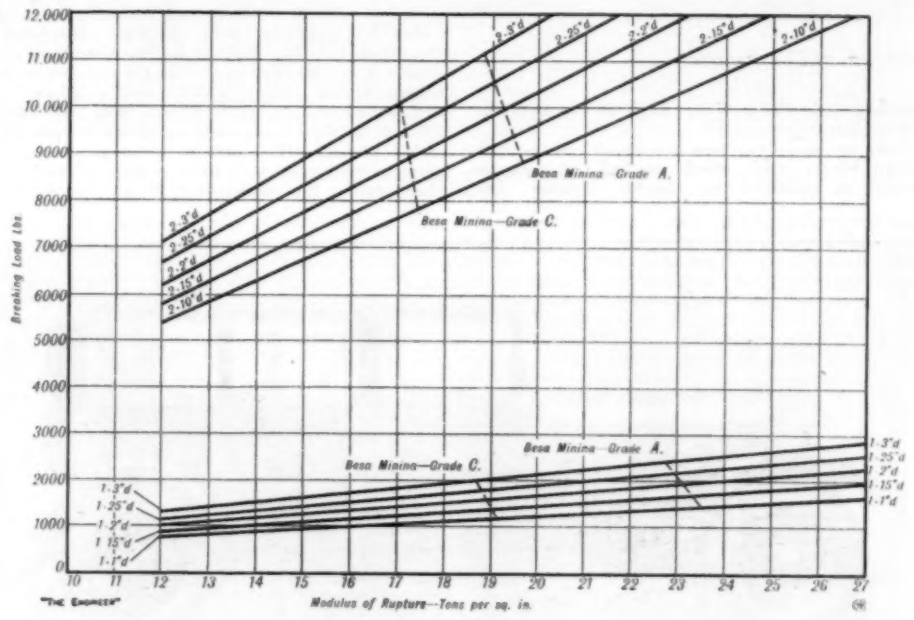


DIAGRAM OF RUPTURE MODULI

Obituary.

WILLIAM FOX.

BY the death of Mr. William Fox on Wednesday, October 10th, at his home at St. Anne's-on-Sea, a well-known figure in Lancashire engineering circles has passed away. Mr. Fox, who was in his seventy-third year, was born at Hathersage in Derbyshire, and he served his apprenticeship with a firm in Leeds, afterwards going to Manchester, where he was employed by Galloways, Ltd. When a commencement was made with the construction of the Manchester Ship Canal, Mr. Fox joined the engineering staff, and when the waterway was opened he was appointed mechanical engineer to the company, a position which he retained until his retirement in September, 1926, when, owing to ill-health, he took up residence at St. Anne's-on-Sea. Mr. Fox was a member of the Institution of Mechanical Engineers and of the Institution of Naval Architects. How as for many years on the Council of the Manchester Association of Engineers and was President for the year 1910–11.

BOOKS RECEIVED.

North Staffordshire: Its Trade and Commerce, 1928. Derby: The Bembrose Publicity Company, Ltd., Wellington-street.

Volumetric Glassware. By Verney Stott. London: H. F. and G. Witherby, 326, High Holborn, W.C. 1. Price 20s. net.

British Rainfall, 1927. London: His Majesty's Stationery Office, Adastral House, Kingsway, W.C. 2. Price 15s. net.

Railways. By W. V. Wood and Sir Josiah Stamp. London: Thornton, Butterworth, Ltd., 15, Bedford-street, W.C. 2. Price 2s. net.

Technical Data on Fuel. Edited by H. M. Spiers. London: The World Power Conference, 36, Kingsway, W.C. 2. Price 10s. 6d. net.

Schmiermittel und ihre richtige Verwendung. By Dr. Curt Ehlers. Leipzig: Otto Spamer, Heinrich-strasse 9. Price 10 marks net.

Industrial Management. Second edition. By R. H. Lamburgh. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 22s. 6d. net.

Strength of Materials. Seventh edition. By M. Merriman. Revised by T. Merriman. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 8s. 6d. net.

Structural Engineering. Fourth Edition. By J. Husband and W. Hurly. London: Longmans, Green and Co., Ltd., 39, Paternoster-row. E.C. 4. Price 16s. net.

Elements of Highway Engineering. Second edition. By A. H. Blanchard and R. L. Morrison. London: Chapman and Hall, Ltd., 11, Henrietta-street, W.C. 2. Price 18s. 6d. net.

Enamels: Their Manufacture and Application to Iron and Steel Ware. By L. R. Mernagh. London: Charles Griffin and Co., Ltd., 42, Drury-lane, W.C. 2. Price 18s. net.

An Introduction to the Theory of Eddy-current Heating. By C. R. Burch and N. Ryland Davis. London: Ernest Benn, Ltd., Bouverie House, Fleet-street, E.C. 4. Price 12s. 6d. net.

Proceedings of the Institution of Heating and Ventilating Engineers, 1926–1927. Volume XXV. London: The Institution of Heating and Ventilating Engineers, 12, Russell-square, W.C. 1.

Mineral Resources of the United States. Part I., Metals; Part II., Non-metals. Compiled by F. J. Katz. Washington, D.C.: The Superintendent of Documents, U.S. Government Printing Office, U.S.A. Price, Part I., 1·25 dollars; Part II., 1·00 dollars net.

Motor Car Show at Olympia.

No. II.*

THE number of exhibitors of motor cars at Olympia is somewhat fewer than at last year's Exhibition, and that has enabled the Society to place at the disposal of some of the more prominent makers larger space, thus enabling them to show a wider range of products than previously, and it is on that account that the total number of cars shown has been increased. American car builders are more fully represented than they have been at any previous Exhibition, and it is evident from that that the import tax on motor vehicles is not damping their endeavours to retain, if not to increase, the foothold they have obtained in Great Britain and the Colonies. With regard to colonial trade, by the way, it is interesting to note that in 1927 British builders exported 35,000 vehicles, or 17 per cent. of their output, against 6000 in 1923. Mr. Douglas Hacking, the Minister for Overseas Trade, speaking at the Motor Show dinner last week, said that 80 per cent. of the cars sold in this country were home produced, and that with the aid of the McKenna duties British makers could challenge the world. British firms, however, do not appear to be getting all the trade overseas that is possible, and that, according to Mr. Hacking, was because few of these firms could afford to have their own individual sales and service depôts. He suggested that something might be done to remedy this disability by a pooling of resources at the marketing end.

Last week we referred to the competition for favour between engines fitted with overhead and side-by-side valves. For efficiency, probably greater importance attaches to the shape of the combustion chamber than to the position of the valves. In the best-designed engines much higher compression ratios are obtained now than formerly; 6 to 1 is now not uncommon. In the same way, engine speeds have increased. Some of the tiny engines in the small car class run up to 4000 revolutions per minute.

Four-wheel brakes are now regarded as standard fittings on every car, and there are few parts of the car mechanism that have undergone so much improvement as brake systems. Pneumatic and hydraulic power are being more and more extensively used, and they relieve drivers of a large amount of physical exertion. The Lockheed hydraulic braking system has much to recommend it. Briefly, this system comprises a compensating master cylinder contained in a supply tank, operated by a foot pedal, and supplying the piping system which is connected by flexible hoses to the power cylinders on the wheel brake shoes. The flexible hose connection in this system provides for the steering movement, and adapts itself to the spring movement of the chassis. By means of mechanical connections between the pistons and brake shoes the latter are brought into contact with the drums and the pressure on corresponding shoes on all four wheels is equalised. The fluid used in this brake system is a mixture of neutralised castor oil and denatured alcohol treated with chemical reagents to counteract the action of the fluid on the metal and rubber parts.

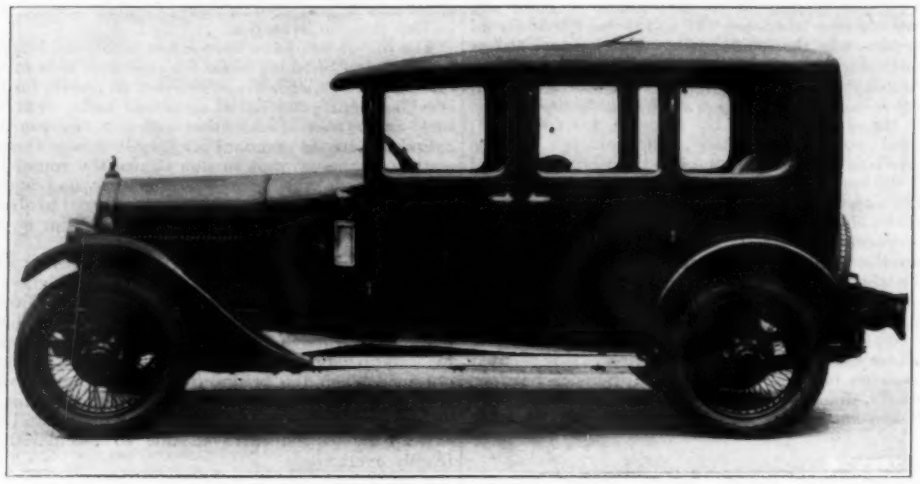


FIG. 9—AUSTIN 16 H.P. SIX-CYLINDER FABRIC SALOON

There are one or two new free-wheel systems at the present Show. One, which we had not seen previously, is exhibited by Clayton Wagons, Ltd., Lincoln. The Clayton-Currin "Coaster," as it is called, differs from other free-wheeling devices in that it involves the use of no ratchets, pawls or jamming rollers, nor is it an over-running clutch. It consists essentially of a friction clutch of the single dry plate type placed behind the gear-box and between the latter and the back axle. It is operated by the vacuum or suction in the engine induction pipe, which varies with the position of the throttle, so that the operation is automatic and synchronises with the speed of the engine or the throttle opening. With the throttle closed, or in the slow-running position, the fairly high vacuum which exists in the induction system causes the "Coaster" clutch to be withdrawn, thus freeing the road wheels from the driving mechanism. When the accelerator is depressed and the throttle opened, the vacuum is reduced and the clutch is engaged more or less. It is claimed that the mechanism can be so arranged that, on full throttle when the engine is giving its maximum power and the vacuum in the induction pipe is at its lowest, the clutch is fully engaged, and that through the whole range of engine speeds the loading of the coaster clutch is proportional to the torque of the engine.

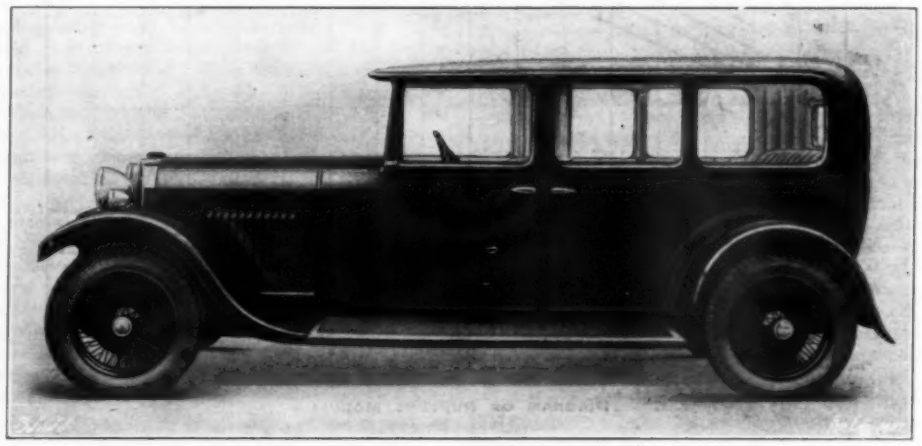


FIG. 11—SUNBEAM 20 H.P. SIX-CYLINDER ENCLOSED LIMOUSINE

Another new free-wheel device is the Millam fitted on Arrol-Aster cars. In this device the principle of the roller and wedge is employed. It is claimed that the construction lends itself specially to accuracy of manufacture, since the driving wedge members are separate parts which can be reproduced within very close limits. The device also embodies a new load-equalising principle. All the roller reactions are transmitted to a floating ring which equalises the loads between the rollers and eliminates radial load on the bearings. This free-wheel device is silent in action and when free-wheeling there is little friction; whilst by a simple arrangement it can be made positive in both directions, so that, in emergency, the engine is available as a brake. It also comprises a sprag device which is operated by the mechanism that disengages the free wheel. This device is inserted into the propeller shaft.

For the owner-driver one of the bugbears of motoring is the cleaning of cars, and especially of the bright plated fittings, of which there are now so many, both inside and outside. Nickel-plated goods are liable to tarnish and the plating may rub off in course of time. There is a growing tendency to replace nickel by chromium plating. The advantages of chromium for this purpose are its hardness, which makes it difficult to scratch, and its ability to keep bright without cleaning by metal polishes. Unfortunately, it is more expensive than the ordinary plating, because it involves an additional process to nickel plating. The article to be treated is first plated with copper, then with nickel, and finally with chromium. We understand that Rudge, Whitworth and Co., Ltd., have experimented with chromium plated wire road wheels with some success. It is claimed that wheels plated in this way are very easy to keep clean, as mud does not adhere to them. This is a most desirable feature, for wire wheels are usually very difficult to clean.

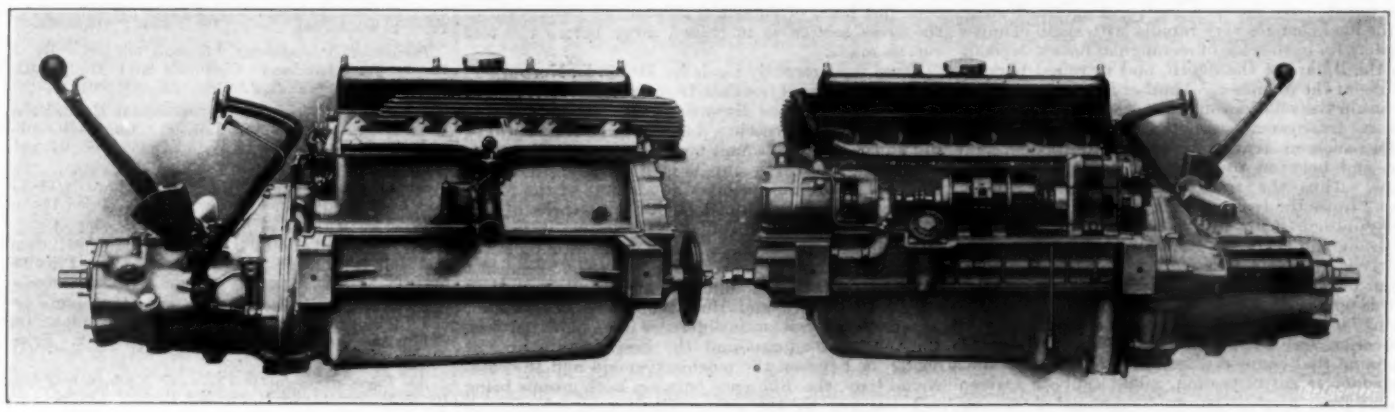


FIG. 10—SUNBEAM 20 H.P. SIX-CYLINDER ENGINE

AUSTIN.

The Austin Motor Company has a full range of exhibits, comprising the 20 H.P. and 16 H.P. six-cylinder cars, and the 12 H.P. and 7 H.P. cars which

* No. I. appeared October 12th.

have four cylinders. The 20 H.P. car cylinders are 79·5 mm. bore and 114·5 mm. stroke. The total capacity of this engine is 3400 c.c., and the power developed is 49 B.H.P. at 2000 revolutions per minute, the Treasury rating being 23·5 horse-power. In this engine the balanced crank shaft is carried in eight main bearings. This method of suspension gives practically entire freedom from vibration, but the makers also fit a vibration damper at the front end of the shaft. Amongst the recent improvements on the 20 H.P. car is an oil cleaner. This chassis is only used for saloon cars. The real novelty on this stand is the 16 horse-power light six-cylinder saloon car, of which we give an illustration in Fig. 9. This

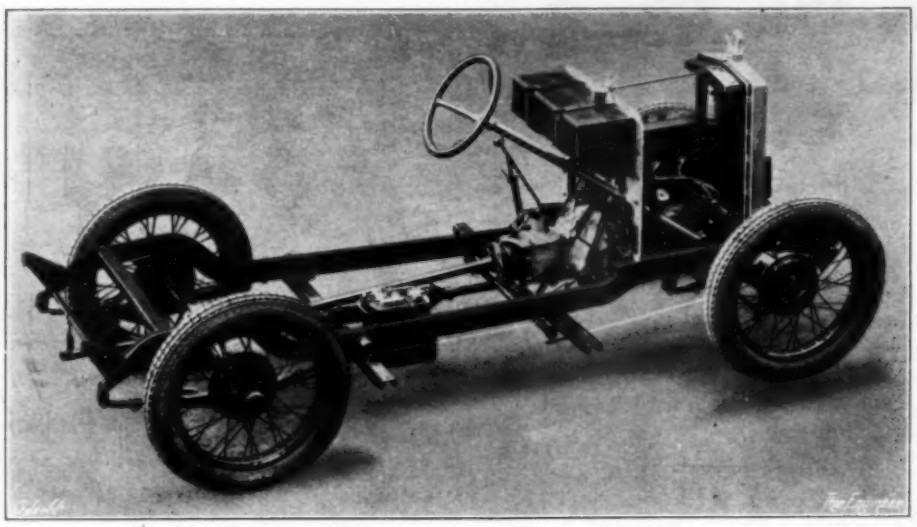


FIG. 12—MORRIS 8 H.P. CHASSIS

saloon is made either with aluminium panels or with fabric, as shown. It is built on a steel base that is a "former" upon which the fabric is stretched. This method of manufacture is claimed to ensure firmness of form and stability in use, so that the body retains its shape. The light six engine has a bore and stroke of 65·5 mm. and 111 mm., with a capacity of 2249 c.c., and an R.A.C. rating of 15·9 horse-power. As in the case of the larger six-cylinder engine, the crank shaft is carried in eight bearings. The engine has side-by-side valves. Certain modifications are common to all the Austin models, except the seven. The petrol tank, which is carried between the two centre cross members in the frame, has now an improved filler orifice, which emerges near the driver's seat. This arrangement, with its telescopic extension piece, so facilitates replenishment that the driver need not leave his seat to remove or replace the filler cap. In addition to this, the petrol gauge, which records in gallons, is mounted on the instrument board, directly in front of the driver. Dipping reflector lights, operated by a small plunger, mounted under the instrument board, are now a feature of these cars. Another modification which contributes largely to ease of running and road-holding qualities is in connection with the springs. The suspension system has not been altered, but between the leaves of each spring are fitted zinc plates, which reduce the friction between the plates and lubrication is no longer said to be necessary. As regards the 7 horse-power car, some notable alterations will be found. The gear-box speedometer drive and the more central position of the speedometer are improvements, as well as the position of the gear lever. The radiator has been altered, and, being higher, improves the lines of the body. There is an extended starting handle shaft, which facilitates "swinging" when the radiator is enclosed in a "muff." On the shock absorbers a brass disc is now fitted at the friction pivot point on each side of the frame member to separate it from the friction discs. The shock absorbers are thus rendered more efficient and are less affected by mud and dirt. On the front and rear shock absorbers rubber bushes have replaced those of wood formerly used in the arm anchorages to the axles. Several improvements have been affected in the body details, and we noted that coil and battery ignition was fitted in place of magneto.

SUNBEAM.

The Sunbeam Motor Car Company is exhibiting five cars fitted with engines from 16 to 35 horse-power. Our illustration Fig. 11 shows the 20 horse-power enclosed-drive limousine, which is an entirely new design and mounted on a specially long wheel base chassis. It has a fixed partition dividing the front seat from the rear compartment, and the latter has two folding occasional seats, thus making it a seven-seater car when required. The wheel base of this chassis is 10ft. 11¾in. long and the overall length 14ft. 10¼in. It has four-wheel brakes operated by Dewandre vacuum servo. The engine, which is illustrated in Fig. 10 has six cylinders, 75 mm. bore by 110 mm. stroke, with a Treasury rating of 20·9 horse-power. Overhead valves, centrifugal pumps, water circulation, forced lubrication, magneto ignition and Claudel-Hobson carburetter are features of the power unit. For the transmission system there are a single plate drive, four forward speeds and a reverse, right-hand side gear change, and bevel drive. Internally expanding brakes are fitted to all wheels. The various parts of the chassis are lubricated from a common centre and the dynamo and electric starting set are by the Rotax Company. The head lamps are fitted with dipping reflectors. The coach-built saloon on the same chassis is a new design, and it embodies many features designed for greater comfort and convenience. The doors are brought down below the line of the chassis frame so as to provide increased body space, and the body is insulated from the frame itself. Special attention has been given to the seating. The front seats are of the bucket type, each adjustable for position, while the rear seat is also adjustable, and the angle of the rear squab can be altered. There are comfortable arm rests for the rear seat, and removable down-filled cushions over the usual seat cushions, which are made up on spiral spring cases stuffed with best curled hair. All the floorboards are covered with pile carpet, and the lower portion of the back of each front seat and the lower portion of all doors are similarly covered.

MORRIS.

The new productions of this Oxford firm include two entirely new models, one in the "baby" class being known as the "Morris Minor," and the other a higher powered six-cylinder car. Illustrations of the two chassis are given in Figs. 12 and 13. There is nothing freakish in either of these new cars. The engine of the small car has a bore of 57 mm. and a stroke of 83 mm., giving a cubic capacity of 847 c.c. The four cylinders are cast *en bloc*, the cylinder head, which carries the overhead cam shaft and the overhead valve gear, being readily detachable. The cams operate the valves, which are of nickel steel, through the medium of taper fingers mounted on excentric bushes, which enables the tappet clearances to be adjusted accurately and with simplicity. All the valve gear is enclosed by a ventilated detachable oil-tight cover. The crank shaft has two bearings, that at the front being of the roller type and that at the rear plain. The connecting-rods are of steel and the pistons of aluminium. The clutch is single plate, toggle operated. Gaseous mixture is supplied by an automatic S.U. piston-type carburetter, gravity fed from a 5¼-gallon tank. The carburation system incorporates a hot spot to ensure easy starting and a good pulling from cold, and there is a mixture adjustment control to give variation of jet setting for varying fuels, atmospheric conditions, &c. A two-level tap is incorporated in the tank to give a reserve petrol supply.

The "Morris Minor" engine is automatically lubricated by a submerged pump that delivers oil at high pressure to all bearings, valve gear and working parts. The gear-box provides three speeds forward and a reverse, with central control. All gears are ground. The drive is taken from the gear-box to the rear axle by an open propeller shaft fitted with a Hardy disc universal joint. The back axle has a spiral bevel gear final drive. The foot brake operates internally expanding shoes on all four wheels, while the hand brake, which is of the transmission type, operates on a drum behind the gear-box. All the brakes are direct in operation and readily adjustable. Coil ignition operating on a 6-volt circuit is provided, the distributor having a variable advance and retard control. The whole of the electrical equipment is of Lucas manufacture and incorporates a five-lamp lighting set, starter motor and a battery. Detachable wire wheels fitted with Dunlop balloon tires are fitted. Semi-elliptic springs arranged on both axles and shock absorbers are also provided. The wheel base is 6ft. 6in. and the track 3ft. 6in.

The other new car by Morris is a 17·7 horse-power six-cylinder car with the engine built in unit construction with an enclosed clutch and three-speed gear-box mounted on resilient fixtures in a tapering frame to which axles giving a wheel base of 9ft. 9in. and a track of 4ft. 8in. are attached by long semi-elliptic springs fore and aft. The bore and stroke of the engine are 69 mm. and 110 mm., giving a cubic capacity of 2468 c.c. approximately 2½ litres.

The six cylinders are cast *en bloc* and the skirt of the crank case is carried well below the crank shaft centre to provide a deep girder structure, which is further reinforced by cross members of box section. A crank shaft of the four-bearing type, having large dimensions, is employed. It is machined all over and is balanced statically and dynamically by the Olsen method. The valve gear incorporates an overhead cam shaft, operating inclined valves which have their seatings in a combustion chamber of new design. A roller chain fitted with an automatic tension device, to which has been added a patented feature to simplify dismantling and reduce backlash, drives the cam shaft, dynamo and water impeller. The half-time gear is carried by the head in such a fashion as to make it possible to remove the head for decarbonising without upsetting the timing or necessitating any chain detachment or re-adjustment. This arrangement has also been patented. The big end bearings, which are of the full ring type, are of white metal in bronze shells. Aluminium pistons of the three-ring style are fitted, the lower ring being of the oil-seal pattern.

The induction pipe feeds independent ports, the passages being as short and direct as possible. The mixture is supplied by an S.U. carburetter, which is furnished with a horizontally pivoted throttle to

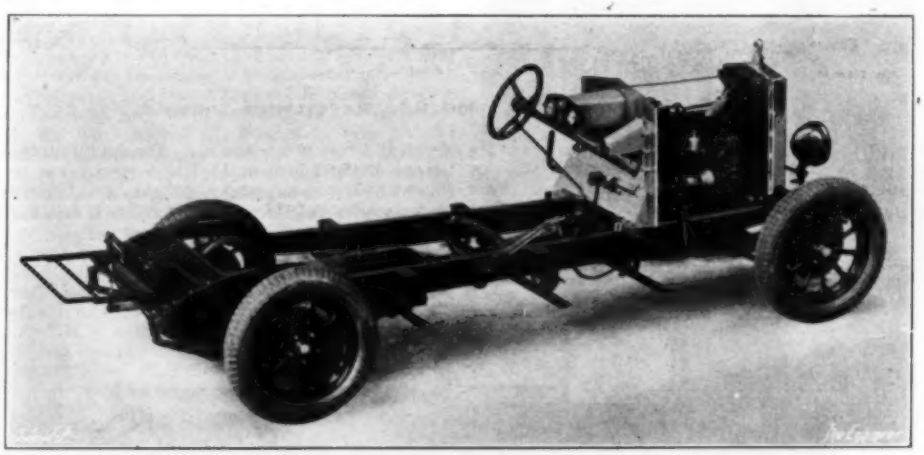


FIG. 13—MORRIS 18 H.P. SIX-CYLINDER CHASSIS

secure equal distribution. The lubrication system is full forced feed by a spur gear pump arranged outside the engine. The construction of the oil pump carrier is such that the pump is always flooded with oil, so that there may be no danger of failure due to lack of priming. A tray pattern filter gauze of large dimensions is fitted to the sump. An impeller, driven from the tail end of the dynamo shaft, circulates the cooling water from the bottom of the cylinder jacket upwards. The water is in contact with every part of the heat-generating surface in the head and leaves the cylinder head by three ports to ensure even distribution. The distributor for the coil and battery ignition runs at one-half the engine speed. It is placed vertically at cylinder head level. The dynamo is driven by a flexible disc coupling and is situated alongside the engine, readily accessible and detachable. The

starter motor is of the gear type and when removed discloses the timing positions marked on the toothed fly-wheel. The clutch is of the multi-plate pattern and has cork inserts for the friction surfaces, the corks being fed with oil to ensure sweetness of action and long life. The gear-box has three speeds and the gears are of case-hardened nickel-chromium steel. The tail end of the main shaft and a sturdy one-piece lay shaft are carried in roller bearings instead of the more usual plain bushes. Large ball bearings are fitted in the usual positions. The sliding gears are mounted on a splined shaft, which is ground all over. The foot brake operates shoes in 12in. reinforced brake drums mounted on all four hubs. These shoes are of the internally-expanding type and are lined with the highest quality friction material; shields are provided to exlude all the dust and dirt. The hand brake takes effect on separate shoes in the rear drums. Accessible nuts are provided to enable quick brake adjustment to be effected.

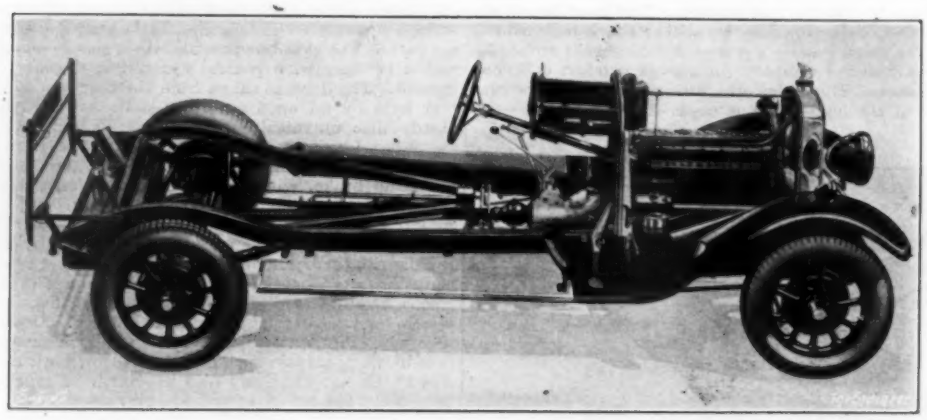


Fig. 14—Rover Two-Litre Six-Cylinder Chassis

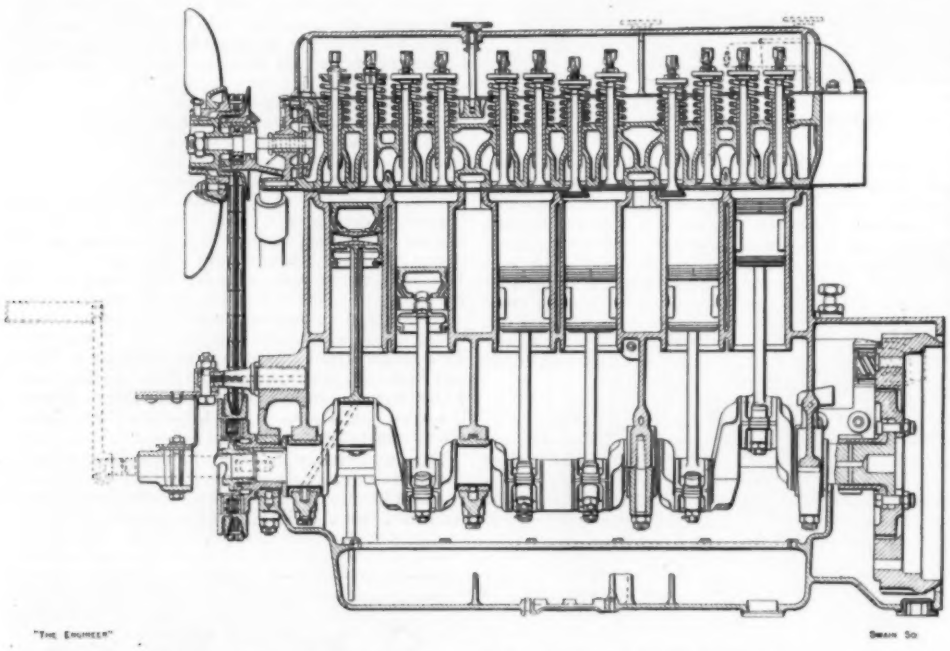


Fig. 15—Rover Two-Litre, 15·7 H.P., Six-Cylinder Engine

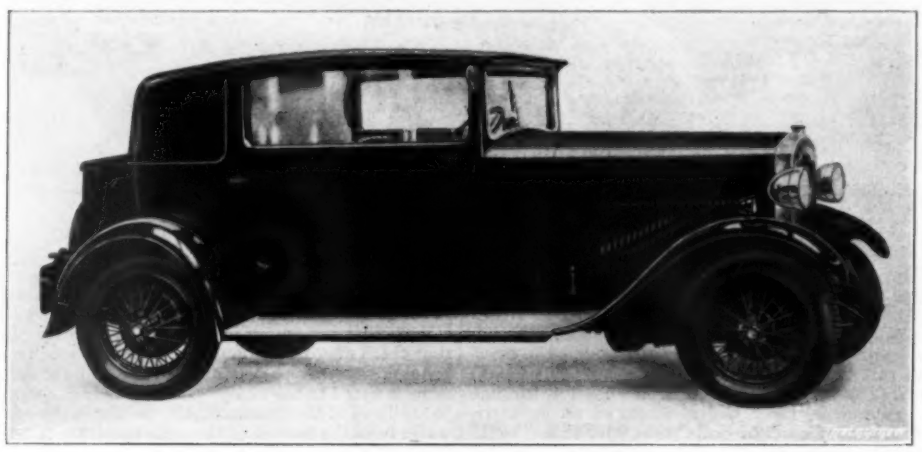


Fig. 16—Rover Sportsman's Coupe

Rover.

The Rover Company's 1929 programme includes only two chassis, namely, the 10–25 horse-power four-cylinder and the 2-litre six-cylinder chassis, of which we give an illustration in Fig. 14. This chassis is fitted with several kinds of body, including coach-built and Weymann saloons and a Weymann coupé, which is a very attractive car. The leading technical details of the 2-litre or 15·7 horse-power car are as follows:—Bore and stroke, 65 mm. and 101·6 mm.; engine capacity, 2023 c.c.; firing order, 1, 5, 3, 6, 2, 4; compression ratio, 5–1; gear ratios, 5·3, 9 and 21·5 to 1; wheel base, 9ft. 10in.; track, 4ft. 8in.; ground clearance, 9in.; and overall length, 13ft. 9in. The six engine cylinders are cast in one block with a detachable cylinder head carrying the valves and rocker gear. The cam shaft is driven by silent chain from the crank shaft. The pistons are of an aluminium alloy and are fitted with two rings and scraper ring. The crank shaft is carried in four large main bearings, which are housed in cast iron. A Lanchester vibration damper is fitted at the front of the engine. Every bearing in the engine is lubricated under pressure. The overhead valve gear is also kept continuously lubricated, while the cam shaft runs in a bath of oil. The engine is water cooled by pump circulation and a fan is also provided. Coil and battery ignition is fitted as standard, with the distributor placed high up in an accessible position. The fuel tank is placed at the rear of the chassis and there is a vacuum feed to the carburetter. A two-way cock is provided on tha tank to give warning when the supply is running low, and a gauge is also fitted on the tank. The electrical equipment includes a Lucas 12-volt starting and lighting set with dipping reflector head lamps. The dynamo is driven by adjustable silent chain.

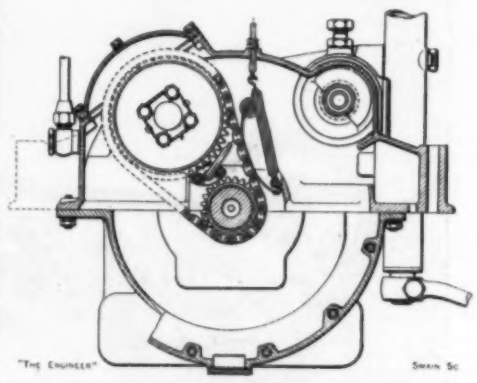


Fig. 17—Rover Engine Timing Chain Drive

The clutch consists of three plates with cork inserts and runs in oil automatically supplied from the engine. The gear-box, which provides three forward speeds and a reverse, is also automatically lubricated from the engine. The propeller shaft is enclosed and provided with a central bearing and the back axle, which is of the spiral bevel type, is very efficient and noiseless. All four wheels have large, internally expanding brakes. On certain models they are operated by Dewandre vacuum servo; on other models by direct mechanical action. Semi-elliptic springs are fitted front and rear, with shock absorbers. Sectional views of the engine are given in Figs. 15 and 17, while Fig. 14 is a general view of the chassis. Fig. 16 represents a view of the sportsman's coupé body, which can be applied to either the 10–25 horse-power or 2-litre chassis. This is built on the Weymann system.

(To be continued.)

SIXTY YEARS AGO.

Glasgow University was established by Papal "Bull" in January, 1451, and for a few years carried on its activities in a small building near the Cathedral. Then it became possessed of some nearby land, on which it proceeded to build. Portions of the building survived for about 400 years. During the second part of the seventeenth century considerable additions were made. In the front part of the college facing the east side of the High-street, James Watt laboured as a philosophical instrument maker, when the incorporated trades debarred him from practising within the city on the grounds that he was not a burgess. It was in this old college, too, at a later date that Sir William Thomson began his distinguished career as a scientist and teacher, and there, also, sixty years ago, we would have found Macquorn Rankine at the head of the engineering department, busy establishing principles and theories with which all modern engineers and naval architects are familiar. In 1864 the site of the college and the adjoining land was sold to the Glasgow and South-Western Railway for the purpose of erecting a station, and the opportunity was seized to build a new university on a commanding height west of the city near the confluence of the rivers Clyde and Kelvin. Work was begun in 1866 and was planned to be finished in 1870. On October 8th, 1868, the Prince and Princess of Wales laid the twin foundation stones of the new building in the presence of some 20,000 spectators. In our issue of October 16th, 1868, we recorded the performance of the ceremony and gave a brief description of what the new building would be like when it was finished. The architect was Mr. G. G. Scott, and the principal contractors were Mr. John Thompson, of Peterborough, for the masonry and carpentry, and Messrs. McIlroy, of Glasgow, for the ironwork. The cost of the undertaking was estimated at about £360,000. Towards that sum one-third was provided from the university properties, one-third from a Government grant, and one-third from a subscription of "almost unparalleled munificence" from the citizens of Glasgow. The new building survives to-day in all its dignity, but, like the old college, it has long since outgrown the continually increasing number of students and of subjects of study, and has ceased to provide the room required for the continually extending appliances necessary to the teaching and advancement of physical and mechanical science. It is to-day surrounded by a host of other buildings, which, in the opinion of some, have added more to the utility than to the beauty of Scott's fine conception.

The Gravesend Electricity Works.

THE fact that fairly small electric generating stations sometimes show very good results is well exemplified by the station at Gravesend, where the total works cost per unit sold is only 0·55d. This result is obtained with 13,400 kW of generating plant, working under very ordinary steam conditions, viz., a pressure of 200 lb. per square inch, a superheat of 150 deg. Fah., and a vacuum of 28½in. with the barometer at 30in. The load factor of the station is 38 per cent. based on units generated.

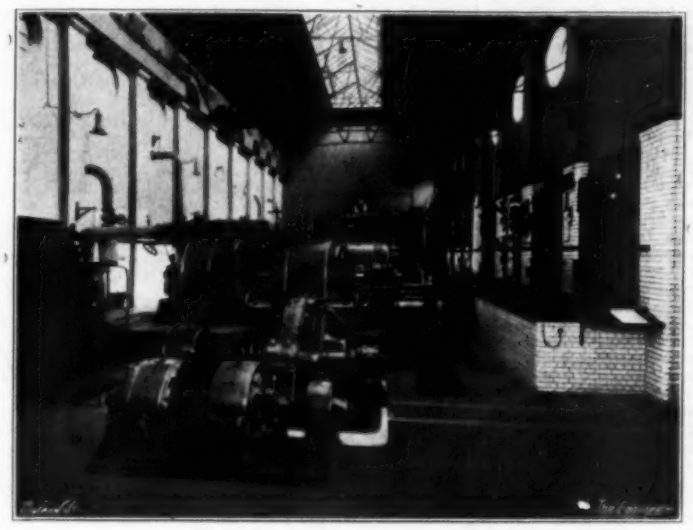


FIG. 1—TURBINE-ROOM

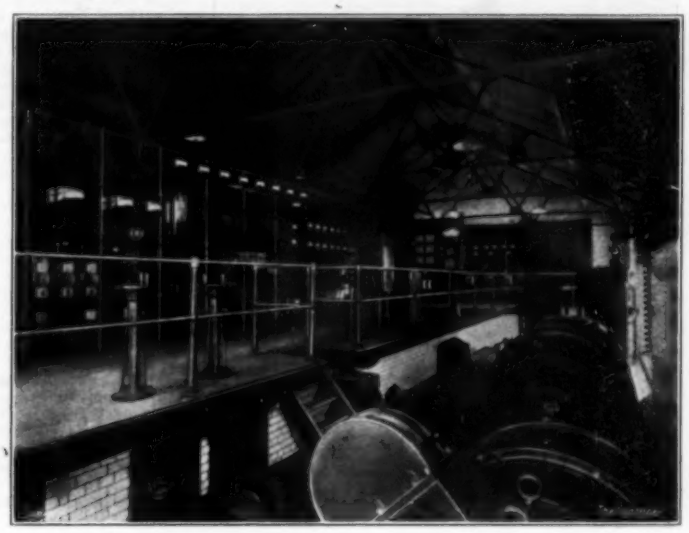


FIG. 2—SWITCHBOARD GALLERY

During the year ending March 31st, 1928, 13,878,005 units were sold. The fuel cost per unit was ·282d.; oil, waste and stores, ·003d.; wages of workmen, ·062d.; repairs and maintenance, ·11d.; rent, rates and taxes, ·03d.; and management, &c., ·063d. The maximum load was 5100 kW. On generating plant, sub-stations and mains a capital expenditure of £381,000 has been incurred or roughly £21 per kilowatt. The capital expenditure on the generating plant recently installed is less than £12 per kilowatt.

Apart from the fact that the station has a good load factor and is well managed, it is situated in a favourable position with certain natural advantages, especially with regard to the supply of water. The station has been erected over a natural water basin, which is utilised to provide both the circulating and make-up water. Each of the 5000-kW turbo-generator sets (two of which have now been provided) is supplied from a boring 300ft. deep, commencing with a diameter of 9ft. and finishing with a diameter of 6ft. 6in. These wells yield 5000 gallons per minute at a temperature of 53 deg. Fah., which does not vary throughout the year, whilst the quality of the water is such that it is rarely necessary to open up the condensers. A high running efficiency is therefore maintained. On test the borings—the largest in the United Kingdom—yielded 7,000,000 gallons per day. After the water has passed through the condensers it is discharged into a canal. An 8in. bore sunk to a depth of 900ft. to the lower greensand gives a supply of soft water at a pressure of some 20ft. to 30ft. above the ground level for make-up purposes. This supply has rendered water treatment plant quite unnecessay, another feature which helps to reduce the working expenses. In due course, when the station is extended and larger generating units are provided, it may be necessary to introduce cooling towers and to abandon the practice of discharging the circulating water into the canal, but at present the water supply system is adequate, and we know of nothing like it in this country.

FIG. 3—PUMP MOTORS

Besides the two 5000 turbo-generator kilowatt sets mentioned there is a 2000-kW set and a 1000-kW unit, all designed for a speed of 3000 revolutions per minute and an overload of 25 per cent. for two hours. They were all supplied by the British Thomson-Houston Company, of Rugby. There are also some small Belliss reciprocating sets, but they are now seldom used.

The undertaking commenced operations twenty-five years ago with three 200-kW sets and three small boilers, costing with the auxiliaries £35,000, whereas to-day the capital expenditure is £381,000. Recent extensions, which include one of the 5000-kW sets mentioned and two Babcock and Wilcox water-tube boilers with an evaporative capacity of 40,000 lb. per hour, were officially opened on Thursday of last week. The two new boilers are fitted with automatic stokers, superheaters, economisers, air heaters, smoke-stacks and duplicate induced and forced draught fans. Each boiler has a heating surface of 6330 square feet; the superheater surface is 1426 square feet; the air heater surface 6070 square feet, and the economiser surface 3447 square feet. Besides these new boilers there are two Thompson and one Yarrow boilers, each capable of evaporating 20,000 lb. per hour.

The new 5000-kW sets exhaust into a Worthington-Simpson condenser with a surface of 5000 square feet. Duplicate steam jet air extractors, duplicate condensate and circulating pumps direct coupled to motors supplied by the Lancashire Dynamo and Motor Company are provided. The extra high-tension and low-tension switchboards were manufactured and erected by the British Thomson-Houston Company, of Rugby. Duplicate extra high-tension bars with isolating switches enable the generators and feeders to be connected to the main or auxiliary bars and the cubicles and panels control the generators, feeders, converting plant and transformers. Originally direct-current switchboards were provided at the east end and in the south wall of the generating station, but these boards are no longer used.

Coal is delivered to the station in barges in the canal basin adjoining the works and is supplied to a coal hopper, from which it is conveyed either to the storage heap or to the boiler bunkers by a Bennis U-link conveyor which runs along the whole length of the boiler-house. On delivery all the coal is weighed and each boiler is fitted with Lea coal measuring apparatus, so that a continuous record of the coal consumption is obtained.

The three-phase current is generated at a pressure of 6600 volts and at the standard periodicity of 50 cycles per second. Consumers in outlying districts are supplied with low-pressure alternating current through kiosk sub-stations, but in the centre area of the district the 230–0–230 direct system has been retained. The direct current is supplied from three automatic sub-stations—Queen-street, Rosherville, and El Teb. The Queen-street station is equipped with 1000 kW of Hewittic mercury vapour rectifiers, the Rosherville station with a 300-kW remote controlled motor converter, 300 kW of rectifier plant and a 1000 ampère-hour storage battery; whilst the El Teb sub-station contains rectifiers with a capacity of 600 kW. The capital cost of the mercury vapour sub-stations was approximately £8 per kilowatt. In all probability the cost of remote controlled rotary converter sub-stations would have been 25 per cent. less, but in the opinion of Mr. McInnes, the chief engineer at Gravesend, the mercury vapour rectifier sub-stations are more reliable than remote controlled converter sub-stations, and as compared with a hand-operated rotary sub-station the automatic rectifier sub-station is far cheaper in annual capital charges plus the cost of labour.

A good idea of the increase in the number of units sold and the steady decrease in the working expenses during the last twenty years can be gained from the following figures:—

Year.	Units sold.	Max. load.	Con-sumers.	Cost per unit sold.
1908	942,203	670	407	1·25
1913	1,202,467	855	763	1·346
1918	2,285,401	1,100	1,041	1·33
1923	6,484,693	2,760	1,653	1
1928	13,878,005	5,100	4,100	0·55

The surplus profits after paying interest of capital, sinking fund and loan repayments during the past five years have been as follows:—

1923.	1924.	1925.	1926.	1927.	1928.
£6,047	£9,865	£8,857	£14,631	£12,489	£12,885

These profits have gone hand in hand with a steady decrease in charges, and the charges made for electricity in Gravesend to-day are amongst the lowest in the country. The Gravesend station is one of the selected stations for the South-East England area, a fact that reflects great credit upon Mr. C. F. McInnes, the Borough Electrical and Consulting Engineer.

In Figs. 1 and 2 we give views of the turbine room and switchboard, whilst Figs. 3 and 4 show the pump motors which draw the water from one of the artesian wells, and the new boilers.

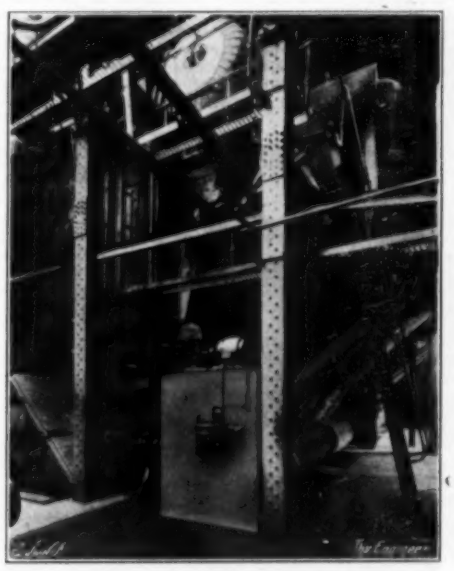
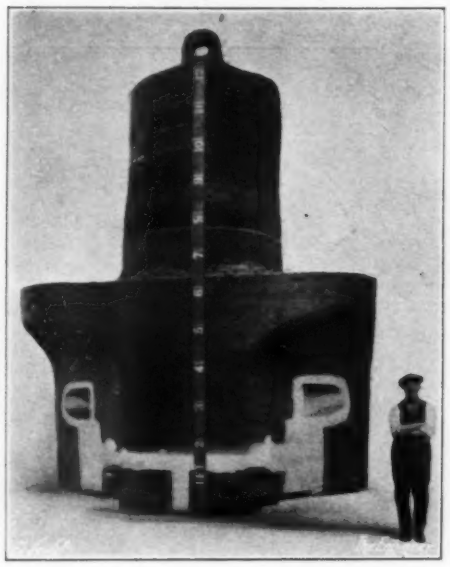


FIG. 4 PART OF BOILER-HOUSE

EXIDE BATTERIES.—At a luncheon held at the Clarendon Restaurant, Hammersmith, on Thursday, October 11th, the chairman of the Chloride Electrical Storage Company, Ltd., referred to the advances made during recent years in the production of Exide motor car and wireless batteries. Economies in production have been passed on to the consumer. In 1920 the most popular Exide starting battery was sold for £8 2s., whereas to-day the price is £3 5s. No fewer than 124 types of car-starting batteries are now made. For wireless purposes the company has developed a large high-tension battery with a capacity of 10,000 milliampères, suitable for public address equipments, photo-telegraphy, talking pictures, and high-power receivers requiring a very high anode current. For portable wireless sets special cells have been developed which are absolutely unspillable. The company's well-known "WH" high-tension battery has been reduced in price in stages and is now claimed to be the cheapest high-tension battery of its capacity on the market. To facilitate charging batteries the company has introduced an Exide trickle charger in three designs, namely, one for low-tension batteries, one for high-tension batteries, and one that will charge both types of batteries at the same time.

A Very Large Steel Casting.

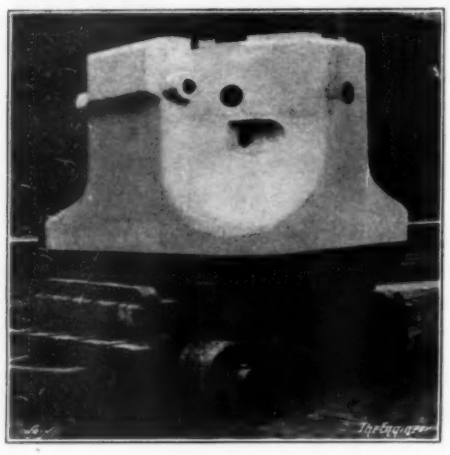
What is believed to be the largest steel casting yet made has just been completed by Cammell Laird and Co., Ltd., of Sheffield. It was made to the order and specification of B. and S. Massey, Ltd., of Manchester, for the Firth-Derihon Stamping Company. The combined haulage capacity of five road engines was required to transport it. This casting, illustrated herewith, is an anvil block for a friction drop stamp designed for use with a 5-ton tup, and was unusual not only for its size but design. The chemical analysis was :—Carbon, ·251 per cent. ; silicon,



Block as Cast and Fettled

·207 per cent. ; manganese, ·881 per cent. ; sulphur, ·041 per cent. ; phosphorus, ·040 per cent.

Previously hammer blocks of this size have either been built up or made of cast iron. The casting being of mild steel, a forged plate of armour quality steel was dovetailed into the top surface to take the wear caused by the die block. The cast weight of the block, including a feeder head of 30 tons 10 cwt., was 142 tons, and the machined weight was 95 tons 2 cwt. Particular care was taken by all concerned to ensure success. An exact wooden model was constructed beforehand to examine all the possibilities of casting, handling and machining. The block was cast with the working face downwards, and two 70-ton open-hearth furnaces were used for the charge. For handling purposes, a lifting-eye, such as is used for armour plate and other large ingots, was cast into the feeder head, and was left in place until the whole working face had been



Finished Anvil Block

machined. To avoid the use of small cores in such a weighty casting the block was cast solid, and all holes were machined out. In boring out these holes no sign of contraction cavities or other defects was discovered. The casting, we are informed, has been so great a success that Messrs. Cammell Laird have already received a further order from Messrs. Massey for a large block, and, in addition, have had inquiries for similar blocks from other firms.

South African Engineering Notes.

Rhodesia's Base Metal Wealth.

The development of Northern Rhodesia as a base metal producing country of first-rate importance is one of the most interesting and significant features of the mineral industry of the sub-continent at the present time. It is interesting because of the large number and varied character of the deposits that are being exploited and on account of the immense sums of money expended and being spent, the fine array of technical talent employed, and the various methods and processes, both mining and technical, which have been tried and adopted.

According to Mr. Carl Davis, technical director of the Anglo-American Corporation of S.A., Ltd., he considers it quite likely that the copper outputs of Northern Rhodesia will work up to the production which the Congo mines have recently been recording, namely, about 80,000 to 100,000 tons per annum. Indeed, he goes further, for he considers it quite likely that two mines alone in this territory—namely, the Roan Antelope and the Bwana M'Kubwa-N'Kona—will secure an output of 80,000 tons per year. Had he not been the essence of caution he might have gone further, and said that it was likely that three other propositions will in all probability be found equal to as great a production once their at present only surmised potentialities shall have been developed.

If, as men who have traversed some of the out-of-the-way parts of Northern Rhodesia believe, there are base metal riches to be disclosed greater than any so far unearthed, then there is no question that three men of such outstanding ability, courage, and resource, as Sir Edmund Davis, Sir Ernest Oppenheimer, and Mr. Chester Beatty, with the entire technical organisation of the Anglo-American Company, Mr. C. B. Kingston, the consulting engineer, Mr. Wilmot, the consulting mechanical and electrical engineer of the group, Dr. Bancroft, the consulting geologist, and Mr. Rogers, the business manager, at their back, will discover them.

To give an idea of the activities proceeding, one may briefly endeavour to convey an impression of the magnitude and efficiency of the organisation that is carrying on prospecting operations in an area several times larger than England and as big as a goodly portion of the Union. The field work which is being carried out under the immediate supervision of Dr. Bancroft, is of a most extensive and thorough nature. It will come as a great surprise to most people to learn that the field examination work which has been in progress for some time past, and which is now being expedited during the present dry months, is, so far as is known, the biggest and most intensive geological survey which is being carried out anywhere in the world, outside of the United States of America. Examination parties, each consisting of two members, are now at work over a very large part of the entire territory of Northern Rhodesia. These field workers extend from Sesheke in the south up to the vicinity of Lake Tanganyika in the north, and the work which they are conducting is being carried out in a most systematic manner, and with meticulous care. There are in the field, at the time of writing, no less than sixty-two men, of whom forty-five are trained and qualified. Those not so qualified are, generally speaking, old-timers in the country, who, by virtue of their knowledge of Northern Rhodesia, and its well-nigh unatlassed spaces, are a most useful aid and adjunct to the properly trained technical men. These men have been drawn from schools of mines and universities in all parts of the world. There are twenty-one parties at work in the Luangwa Concession and nine in the Rhodesia Congo Border Concession.

All this vast concession country has been mapped out into blocks, and in each block there are carried out thoroughly systematic examinations, which, when completed, mean that the areas have been traversed from end to end. The characters and exact location of all outcrops are described and contours and nature of vegetation, &c., noted. Field wireless sets are being employed.

The copper deposits of the Belgian Katanga and those on the Rhodesian side of the frontier are two very different kinds of propositions. The Congo mines are, so far, of higher grade character than those in Northern Rhodesia. The mines hitherto opened up are in nearly all cases dealing with oxidised ores, and except in one or two instances, as at Kipushi, there is little or no evidence of the cupriferous ore bodies in depth. The Congo deposits are scattered, and that involves either the building of more than one treatment plant or otherwise lengthy transportation lines, which do not in either instance make for economy in operation.

In Northern Rhodesia they are opening up and will deal with immense tonnages of sulphide ore, and the nature of these occurrences and their metallurgy are more in accordance with experience in other big copper-producing countries, notably America. In all probability, the methods of mining will be shrinkage stoping on a large scale, so Mr. Carl Davis thinks. He does not visualise outcrop or steam or electric shovel working to any important degree in that territory, but considers the practice adopted will be underground mining. The methods of treatment are likely to be mass flotation. The site for a large smelter has not yet been decided on. There are many points to consider in connection with the design and capacity and locality of the smelter. It is quite probable that such a smelter will serve the requirements of more than one mine. The question of the smelter plant, in turn, bears upon that of power. In modern practice the waste heat gases from the furnaces are employed to raise steam, and it is quite probable that that method will be adopted in Northern Rhodesia.

To sum the position up, it may be said that the future of the copper industry in Northern Rhodesia can be regarded with confidence and gratification. The existence of many millions of tons of ore which can and will be treated at a profit is known, and further discoveries are continually coming to light ; in fact, one or two of an exceedingly promising nature have been made recently.

It is deserving of mention also that there are no really difficult mining or metallurgical problems to solve, and the outlook as regards labour and freight charges is satisfactory.

Asbestos.

The asbestos industry in South Africa is advancing rapidly. So far most of the new enterprises are in the Union of South Africa, which not only contains asbestos deposits of huge extent but holds the world's record as regards varieties of fibre, while it occupies the leading position as a crocidolite producer.

At present Southern Rhodesia is a much more important producer than the Union, and the Rhodesian and General Asbestos Company's great White Asbestos property at Shabani is one of the finest mining propositions in the world, producing nearly £500,000 worth of very high grade fibre annually and having reserves almost equal in value to those of the Rand's greatest gold mine—Government Areas. As the output of this mine is to be doubled, and other asbestos mines in Southern Rhodesia are also increasing their output, it may be that even with the number of new flotations in the Union of South Africa Rhodesia will retain the lead. Apparently the activities in the Union and Southern Rhodesia have stimulated research for asbestos in Northern Rhodesia, where previously none had been found. From the far north of that Colony, in the neighbourhood of Lusaka, comes news of a reef find, the samples sent in being described as of exceptional length, running up to as much as 2ft.

Platinum Industry.

The platinum industry continues to make steady progress as the methods of extraction are improved. During the month of July the Ouverwacht Platinum, Ltd., reduction plant treated 2231 tons of ore. The crude platinum produced is estimated to yield 505 oz. of refined platinum and allied metals, equivalent to 4·527 dwts. per ton milled. Up to last month it was believed that in the lower levels the grade of ore had become too low for profitable extraction, but it is now understood that good values have been found in the lowest level, and it may be that this unique mine is to have a fresh lease of life.

During the same period (July) the operations of the Lydenburg Platinum Areas, Ltd., on the Maandagshoek section of its property, resulted in the milling of 3470 tons of ore, from which 707 oz. of platinum group metals were won. Taking the productions of the two mines alone, the value of the platinum produced in the Union has nearly reached the rate of £250,000 per annum, and this is certain to be largely increased before the year is out.

Rhodesian Railways.

During the six months ended March 31st the Rhodesian Railways, including the Veyburg-Bulawayo line and the Rhodesia-Katanga Junction Railway, earned £2,506,637, against £2,404,629 for the corresponding six months of the previous financial year. The total gross operating expenditure (including provision for reserve, for renewals of permanent way and rolling stock) was £1,502,419, compared with £1,335,884, and the net operating revenue was £1,004,218, compared with £1,068,745, a decrease of £64,527. The increased earnings are mainly due to the greater tonnages of Congo fuel and copper handled during the six months, as compared with the corresponding period of 1927. The earnings from general goods traffic have been affected by the considerable reductions made in the rates as from April 1st and July 1st, 1927, and though the volume of traffic dealt with has been greater than in the corresponding period in 1927, the earnings are less. In the case of the earnings derived from the carriage of construction material for Congo Railways and from chrome ore, these show considerable decreases.

Four hundred and seven thousand one hundred and fourteen passengers were carried in the six months compared with 292,814 passengers in 1927. The quantity of coal and coke carried amounted to 433,213 tons, compared with 379,216 tons in 1927. The largest increase (60,000 tons) is in the tonnage railed for the Union Miniere Copper Company, and is accounted for by the continued extension of that company's activities. There was a decrease in the tonnage of chrome ore railed, the quantity being 97,444 tons, compared with 132,854 tons. It must be mentioned, however, that the consignments of ore handled during 1927 were easily a record. The copper for export continues to increase, 49,673 tons being shipped during the six months ended March 31st, 1928, compared with 33,614 tons in the six months ended March 31st, 1927.

B.E.S.A. SPECIFICATIONS.

PAINTING MATERIALS.

Continuing its programme of work in the Paint and Varnish Section, the British Engineering Standards Association has just issued British Standard Specifications for Ochre, Antimony Oxide and Purple Oxides of Iron. Limits for the chemical composition and the physical properties of the materials are specified, and appendices giving standard methods for carrying out the tests necessary for the purchase of these materials are given. The Committee is now nearing the end of its programme, and it is hoped that it will shortly be able to give some time to a review of the published specifications which are now coming into general use. It has been pointed out in previous issues that the specifications will be revised as experience of their working or progress in the industry renders it necessary, and it is therefore desirable that any criticisms which users or manufacturers may have to make should be forwarded to the offices of the Association for consideration.

Copies of these three new specifications can be obtained from the B.E.S.A. Publications Department, 28, Victoria-street, London, S.W. 1, price 2s. 2d. each, post free.

LOCOMOTIVE, CARRIAGE AND WAGON AXLES.

A revised edition of Part I. of the B.E.S.A report No. 24 covering the British Standard Specifications for Locomotive, Carriage and Wagon Axles has just been published. These specifications were last revised in 1921, but since then it has been found desirable to make certain changes to bring them into line with present-day requirements. The principal alterations embodied in the present specifications include the following :—In the specification for Locomotive Crank Axles, the clause on heat treatment has been modified, and the ultimate tensile breaking strength has been specified between the limits of 28 tons to 33 tons per square inch with an elongation of not less than 25 per cent. In the specifications for Locomotive, Carriage and Wagon straight axles the clause relating to the number of axles to be tested has been rendered more explicit and provision has been made for re-tests to be carried out in the event of failure under the falling weight test. Approximate metric equivalents have been incorporated throughout.

Copies of the specification may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria-street, London, S.W. 1, price 2s. 2d. post free.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

A Better Outlook.

The autumn demand for iron and steel gives signs of having now set in, and conditions are more in favour of a reinvigoration of the basic industries of the Midlands and Staffordshire than has been the case at any other period of this year. Last week's quarterly meeting provided some very useful orders, while inquiries circulated lead one to anticipate some excellent business as the quarter develops. The situation as regards continental supplies of raw material is such as to cause habitual users of this material some anxiety. Many of them are sounding local re-rollers, but these latter, on account of the uncertainty of production costs, do not appear disposed to commit themselves far forward. More pig iron business is forthcoming than has been the case of late and values are rising. With the present restricted output of iron and steel any consistent increase in demand is almost bound to send up prices until such time as additional plant for smelting, forging, founding and rolling iron and steel is brought into use. Of this plant there is an enormous idle reserve, sufficient indeed to swamp the market with its output on present consumptive capacity. It will only be brought into action, however, as demand warrants, for it is realised by producers that more profitable prices must be secured before there can be any question of increased production. Indeed, in some departments they have yet, it is claimed, to be raised to a profit-yielding level. Developments as regards both demand and prices are being carefully watched, especially by those consumers who are well placed for business during this, the last quarter of the year.

Steel Improvement.

The steel mills in this area are finding an all round improvement, though the chief department of activity is that relating to the production of bars, billets and special products. In the finished steel branch there is a lack of shipbuilding orders, but the makers of boiler plates are doing well, and substantial orders for big pipes are also absorbing good tonnages of plates of moderate thickness. Structural engineering requirements are calling for moderate tonnages, and an increase in inquiry in this branch is reported. The question of British steel prices is under consideration, in view of the much better position of makers. A possible reduction of the rebate has been mentioned, but makers hesitate to take such a step at a time when order books are showing distinct signs of improvement. The continental situation is likely to be a deciding factor in the case of native steel prices. It would appear that continental producers are not ignoring the British market. The stringency has been relieved slightly this week, but the prices asked by Belgian, French and particularly German houses are not considered sufficiently attractive to justify consumers in placing their business abroad. Steel bars are quoted at £6 6s. 6d. f.o.b.; angles, £6 4s.; joists, £5 5s. 6d.; plates, £6 9s. 6d.; and billets, £5. When the freight is added, the cost is too high for the material to be worth buying in competition with British steel, especially when the possibility of delay in delivery of the foreign product is taken into consideration. Native makers are prepared to supply almost immediately any quantity of angles at £7 17s. 6d., tees at £8 17s. 6d. and joists at £7 17s. 6d., ship, bridge and tank plates at £8 12s. 6d.—all less rebate to buyers of British material exclusively. Boiler plates are quoted £11 and hoops £10 10s. Makers of billets and rolled products have of late seen an increasing volume of orders diverted into their mills, which otherwise would have gone abroad. Rollers of bars and strip have been busier likewise. With their hands thus strengthened, steel makers have been able to raise some of their prices to a more profitable level. Small steel bars range from a minimum of £7 15s. to about £8 2s. 6d., while mild steel billets make upwards of £6 5s. Inquiries are coming in again from the motor car manufacturers, some of whom are at work on their new production, while others are preparing to go ahead with the orders which the Show is expected to produce. Steel scrap sells at £3 7s. 6d. to £3 10s. delivered South Wales. The fall in the volume of steel ingots and castings produced last month, as compared with September last year, is disquieting. The 718,600 tons turned out last month was 70,300 tons more than in August—a very short working month—but 58,400 tons less than in September last year.

Pig Iron.

Midland smelters, some of whom adopted the policy of keeping furnaces going as long as possible, even at the sacrifice of prices, are now reaping a little reward for their enterprise. The demand for pig iron continues slowly to expand and in many instances superabundant stocks of pig iron have been reduced. One considerable organisation is credited with having sold off all its surplus. At most of the blast-furnaces in this district stocks have visibly diminished. Supply still exceeds demand, but the excess has been lessened and those pig iron users, alike at the foundries, the forges, and the mills, who have anything like good order books are thought to be contemplating covering their forward requirements. Particularly are they becoming anxious as to the future because of the much firmer attitude which is being adopted by pig iron smelters. The buyer has been in possession of the whip so long that smelters consider it high time they took a hand at driving. At last week's quarterly meeting in Birmingham, many Derbyshire and Northamptonshire blast-furnacemen advanced their minimum quotation 1s. per ton, and since then other furnaces have come into line. At some of the Midland foundries the amount of work in hand is sufficient to make managements anxious to secure themselves against possible contingencies with regard to raw material. They found smelters prepared to do business, but not at recent low rates. The former minimum prices have disappeared, and new prices have superseded them. Northamptonshire makers want at least £2 16s. for foundry material, many asking up to £2 17s. 6d. Forge iron is being quoted £2 13s. 6d. Derbyshire No. 3 foundry is named £3 to £3 1s., and forge £2 16s. Though in many cases the enhanced price has been conceded for foundry pig, the same cannot be said with regard to forge material. In this department business has advanced but slightly since the summer slackness. It is insufficient, forgemen say, to enable them to raise their prices, which are already out of alignment with production costs. They are, therefore, unable to pay the higher prices asked for forge pig. Midland makers have been competing with some success for the Scottish trade, and at least one very good order is reported. The brisker demand which has developed in the pipe trade, coupled with the clearance of pig iron stocks, has enabled one Derbyshire furnace which is prominently concerned in the pipe trade to rekindle a furnace which has been stopped for some time for relining. Smelters are hoping that the steady decline in the output of pig iron which has been in progress now for many months, and which was again most marked in September, has now come to an end, and that the figures will steadily rise from now on. The output last month—503,900 tons—compared with 519,000 tons in August and 519,500 tons in September, 1927. Of the total quantity produced, 156,700 tons were of hematite, 201,500 tons of basic, 108,700 tons of foundry, and 19,600 tons of forge pig iron. It gives cause for gratification that the number of furnaces in blast showed an increase on the month, if only of one—the total now standing at 131.

Finished Iron.

Last week's quarterly meeting does not appear to have assisted, to any marked extent, the Staffordshire iron trade towards a state of satisfactory trading conditions. Little interest was displayed in this branch of the market, and although makers of marked bars were able to maintain their basis at £12 per ton, the competition for business in medium class iron resulted in the cutting of rates. The prices accepted in individual transactions depreciated by varying amounts from the general quotation. There was only a slow inquiry for cable and anchor iron. Common bars, for nut and bolt and hurdle making, were offered at £8 12s. 6d. upwards. Few consumers, however, availed themselves of the lower price. Belgian No. 3 bars were quoted at £6 3s. 6d. f.o.b., the freight being 22s. Buying of this foreign material continues and aggregates a considerable tonnage.

Galvanised Sheets.

The recent increase in strength of galvanised sheet prices proved at last week's quarterly meeting to be well founded. Demand from some of the most valuable overseas markets, such as the West Indies and India, has undergone something of a revival, and it is expected that large quantities of galvanised sheets will be required for repairing the havoc caused by the recent hurricane, and that British mills will get a good share of the orders. Some mills are now so well placed as not to be in a position to give delivery before next year. Under these circumstances prices are very firm. Corrugated sheets of 24 gauge command from £13 10s. to £13 15s. An increasing proportion of the business booked is at the higher figure. There is not much movement locally in tin-plates. Prices are unaltered.

Activity at the Strip Mills.

There is increasing activity at the Staffordshire strip mills. Makers this week report much better business with manufacturers of motor cars and the stamping and tube-making trades. One firm is said to have taken much more forward business during the past week than for a long time past. A good portion of the business being given out is being transferred from foreign makers. Reduced continental buying has been reported for some weeks past, though small orders continue to be placed abroad. The question of thin strip prices was recently considered by makers in Birmingham, but a decision was postponed, possibly for about a fortnight. Steel gas strip, at date, is quoted £7 15s. to £8 per ton, while wrought iron gas tube strip is named £10 15s. to £10 17s. 6d.

Steel Bars and Stampings.

The trend of events in the steel trade and the automobile industry were touched upon by Mr. Norman W. Godfrey, chairman and managing director of Thomas Smiths' Stamping Works, Ltd., in his annual report this week in Birmingham, of the operation of the firm and its subsidiary company. Speaking of the greater activity which is now going on in the rolling mills, he said the company's rolling mills at Walsall, carried on under the name of J. and W. Marshall and Co., had shared in the greater activity which was at last apparent in the steel trade. During the period of the coal strike, numbers of the firm's customers were compelled to obtain their supplies from the Continent, while the lower prices offered there tempted others to purchase abroad after its conclusion. Now, however, that the margin was negligible many had returned in view of the greatly superior quality of British steel and the better service obtainable. Referring to the motor trade—which constitutes the most important outlet for the drop forgings manufactured at the firm's Coventry plants—Mr. Godfrey stated that that industry had seen something in the nature of a setback during the past season. Supply would seem, he said, temporarily at all events, to have overtaken demand, and there had been a check to the expansion shown in recent years. Few motor manufacturers had been able to fulfil the somewhat ambitious programmes of a year ago, and it had been the firm's frequent experience that manufacturers had been unable to accept delivery in accordance with the terms of the orders which they had placed. Quantities of drop forgings which should have been taken in a few months had proved, in some cases, more than sufficient for the whole year. Despite the unrealised expectations of the motor industry, the firm has had a most successful year, having made a profit of £22,245.

Decline in Overseas Trade.

The substantial decrease in September, both in imports and exports, when compared with the corresponding month last year, has provided somewhat of a surprise to industrialists hereabouts. The decline in the exports of raw materials, amounting to £1,051,000, is a large one, while the reduction in the exports of manufactured articles, £3,583,000, is even more noticeable. In only one previous month—May—of the present year has the value of exports been at a lower level than in the corresponding month of last year. On the import side there was a falling off of £5,813,000 in raw materials and a relatively small one of £881,000 in imports of manufactured articles. It is remarked that, taking imports as a whole, and leaving out of account the exceptional month of May, 1926, imports during September were the lowest recorded since the month of April, 1924, when, however, average values were higher than at present. In the present state of the continental raw material market it is interesting to note that the total quantity of iron and steel imported during the month was 184,464 tons, valued at £1,605,559, compared with 312,018 tons and £2,421,406 in the corresponding month of last year. For the year to date the quantity imported was 2,218,088 tons, valued at £18,368,728, compared with 3,504,821 tons at £26,962,342 in the preceding year.

Severn Waterway.

The Worcester Chamber of Commerce has decided, in spite of the claim put forward by some of its members that the cost of carriage by water exceeded the cost by rail, to urge the Ministry of Transport to accede to the application of the Severn Commissioners for a grant of £15,000 to ensure the maintenance of the Severn Navigation.

Railway Requirements.

Fairly substantial orders for permanent way accessories have, I learn, been awarded by the South African Railway Tender Board to Charles Richards and Sons, Ltd., of Darlaston, and to Guest, Keen and Nettlefold, Ltd.

Unemployment.

Whereas last week I had to record slight increases in the number of unemployed in many of the Black Country towns, despite the fact that the total returns for the Midlands showed a decline, this week I am able to report that those same towns, with the exception of West Bromwich, show recovery. In each case there is now a smaller number of workless and an improvement also having taken place in other Midland districts, a total reduction for the area on the week of no less than 1616 is recorded. The grand total now stands at 181,484, of whom 133,990 are men, 39,190 women, 4207 boys, and 4097 girls.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

Overseas Markets for Textile Machinery.

The official figures relating to the overseas trade in British textile machinery during September point to a pronounced decline compared with the average for the previous eight months of the year, though the falling off may mean nothing more than a temporary lull. For the January–August period the average was almost exactly £1,000,000, but during the month under review the total was no more than £820,497, against £968,812 in August of this year and £1,042,077 in September, 1927. A marked improvement in the takings of the Russian market has not compensated for declines in pretty well every other direction, particularly British India, Japan, and "other European countries." Last month's shipments included 7257 tons of spinning and twisting machinery and 1670 tons of weaving machinery, compared with 7591 tons and 2022 tons in the previous month and 7597 tons and 2629 tons respectively in September of last year. Notwithstanding the decline in exports to British India, that country remained the chief outlet for textile plant shipped from the United Kingdom, the exports thence reaching a value of £166,315. Russia occupied second place with £107,212, followed by Japan, £86,450; Germany, £75,985; France, £53,821; the Netherlands, £45,156; South America, £32,985; the United States, £32,900; China, £19,124; and Australia, £13,839; "other European countries" taking shipments of an aggregate value of £153,889.

Nine Months' Trade.

In spite of the decline in September the exports of textile machinery during the completed nine months of this year are higher than in either 1927 or 1926, the respective values being £8,801,175, £8,500,167, and £7,310,270. Altogether 93,275 tons have been exported, compared with 86,434 tons in the January–September period of the previous year, and 75,301 tons in the corresponding nine months of 1926. In order of importance, the principal markets have been British India, Germany, Japan, the Netherlands, France, South America, the United States, Australia, and China.

Jacking-up Trafford Bridge.

After several months of preliminary operations the task of renewing the steel rollers upon which revolves the Trafford-road swing bridge, spanning the Manchester Ship Canal, is expected to be completed in two or three weeks. Reference to the work was made in this letter recently. Between Saturday night and Sunday morning last traffic was temporarily suspended whilst the bridge, which weighs about 1800 tons, and is 211ft. long, 60ft. wide, and 30ft. deep, was jacked up 6in., an operation which took several hours. The sixty-three steel rollers, which have been in use for about thirty-four years and also the roller paths are to be replaced. Subject to restrictions as to weight and speed a temporary roadway has been constructed for traffic. The Pomona Dock is closed until the completion of the work.

Electrical Engineers' Increased Profits.

The annual report of the directors of Ferranti Ltd., electrical engineers, of Hollinwood, Manchester, for the twelve months ended June, discloses a substantial improvement in the position of the company compared with the previous year, which, of course, was affected by the coal dispute. The net profit of £56,798 compares with £35,982 in 1926–27, and £59,766 in 1925–26, and a tax-free dividend of 20 per cent. on the ordinary shares, which is the same as in the three preceding years, is proposed, the sum of £35,000 being added to the reserve account, which will amount to £270,000. Expenditure on work in progress and stocks and stores figure in the balance-sheet for the sum of £242,563.

University Appointments.

The Council of Manchester University has made the following appointments in the Faculty of Technology:—Lecturer in Municipal and Sanitary Engineering, Mr. Albert Johnson; and assistant lecturer, Mr. M. T. B. Whitson; Lecturer in Physics, Dr. Harry Lowery. The resignation of Mr. Walter Cartwright, assistant lecturer in metallurgy, who has received an industrial appointment, has been accepted by the Council.

Non-ferrous Metals.

In no section of the non-ferrous metal market have values given way during the past week. Copper has registered a further slight advance, and continues without interruption the firmness which has been in evidence for several months; tin has recovered part, at least, of the ground lost a week ago; lead has maintained the advance last recorded; whilst spelter, on balance, is about unchanged at last week's reduced level. In the copper section, there has been a perceptible falling off in the demand for metal, and this had been reflected in the aggregate turnover during the week. This, however, in view of the active buying that has been going on of late, has not been altogether unexpected, and has been without any adverse effect on prices. On the contrary, values at the time of writing are about 5s. a ton higher in the case of standard brands, with refined descriptions firm and unchanged. Transactions in tin have also been lighter, but in spite of fluctuations during the week current quotations represent an advance of roughly £1 a ton since my last report. It may be pointed out that the market continues to regard the statistical position as "bullish" rather than "bearish." Interest in lead has not been particularly pronounced, but prices have been well held. The undertone in the case of spelter appears to be not too confident, and on a moderate demand for the metal prices have been just about maintained.

Iron.

Expectations of higher prices for Midland foundry irons have not been disapponted, and after a period of falling markets which has extended almost uninterruptedly since the beginning of the year, some of the principal producers in the Midland counties, encouraged by the improved position at the blast-furnaces, have taken the lead. The advances that have been quoted on this market have not been substantial in themselves, but may rather be taken as an indication of the changed conditions following a dull period of many months. So far this week the market appears to have been marking time, but it is confidently predicted that other Midland makers will follow the lead, and that consumers will continue to cover their forward needs. For delivery Manchester or equal, Derbyshire furnaces are now quoting about 68s. per ton, and Staffordshire at 67s. 6d., or from 6d. to 1s. a ton higher than before. Other varieties of iron are unchanged at 79s. per ton for Middlesbrough, from 87s. 6d. to 90s. for Scottish, and about 81s. 6d. for West Coast hematite, all delivered into this district. So far dearer imported materials have not deflected much business to Lancashire makers of bar iron, although the latter are not without hope that some improvement in this respect will before long be witnessed. Prices are firm at £10 per ton for Lancashire Crown bars and £9 10s. for seconds.

Steel.

Apart from reports of a slight increase in the forward buying of steel as a precaution against a possible advance in prices, business this week has been confined to the covering of early needs, virtually prompt delivery still being obtainable without much difficulty. Quotations on this market keep very firm at £7 17s. 6d. per ton for joists and sections; £9 15s. for acid and £9 10s. for basic boiler plates; £8 12s. 6d. for ship and tank plates; £8 17s. 6d. for large steel bars; and from £7 17s. 6d. up to £8 2s. 6d. in some instances for small re-rolled bars. The demand for foreign steel materials just now is practically confined to the sale of second-hand parcels by stockholders, some of whom are favourably bought and in a position to shade values to some extent. In view of the high levels which most varieties of imported steel have reached, little is heard at the present time of new forward contracts of any weight. Continental wire rods are quoted for delivery to Lancashire works, for cash against documents, at £6 17s. 6d. per ton, with steel bars at about £7 5s.; angles at £6 17s. 6d.; Siemens plates at £8 3s. 6d. to £8 5s.; joists at £6 7s. 6d.; and bar iron at £7 2s. 6d. per ton.

Manchester Association of Engineers.

The opening meeting of the new session of the Manchester Association of Engineers was held at the Engineers' Club, Manchester, on Friday last, when Mr. William G. Gass, M.I. Mech. E., president, delivered an address, in which he emphasised the necessity for engineers to study the financial side of business affairs. He said the monetary sense or the ability to understand the fundamental conditions of successful business was, unfortunately, not pronounced among engineers, who concentrated on the practical side. It behoved the engineering world to see that some knowledge of the value of money, of trading conditions, of the causes of trading losses, of the general conditions controlling businesses were included in the curriculum of schools and colleges where the studies of higher grade subjects were undertaken. It was sugggested by the author that evening schools and technical colleges should devote courses to the study of financial affairs. Mr. Gass said the war had been responsible for many troubles, and one of the most serious was the false idea of the value of money that had arisen. During the evening the presentation of the Constantine Medal for the best paper read during last session was made to Mr. A. H. Goodger, M.Sc. (Tech.), for his paper on "The Influence of Metals upon Workshop and Design Problems," and the Butterworth Medal was awarded to Mr. Julius Frith, M.Sc., M.I.E.E., for his contributions to the discussions.

BARROW-IN-FURNESS.

Hematite.

There is an improvement in the demand for hematite pig iron, and but for the fact that stocks are still existent in the district, the present output from the furnaces in blast would hardly cope with it. This condition is due to some extent to a bigger demand locally on the part of steel makers, but, on the other hand, the amount of business being done with customers in Wales, Scotland and the Midlands has improved, and a higher tonnage is being dispatched by rail and coastwise than has been the case for many months. This is welcomed by ironmakers, who have been experiencing a very lean time up to six weeks ago. If the demand continues and the outlook remains as promising as it is to-day then it will be necessary to put in more furnaces. At present, however, the amount of iron being produced is below normal. Business is being transacted with the Continent, and there is some chance of it improving. As regards America, there is nôt much to be said at present, as that country does not figure largely as a buyer. The demand for special qualities has improved, and is likely to increase in the early future. Iron ore is in steady demand, but, until more furnaces are put in blast, any improvement can only come from increased demands from outside iron producers. The steel trade is moderate, but Workington has been enabled to restart on railway material, and the outlook is a little better there. The Barrow rail mills continue in operation, and are assured for some weeks of constant running. Further orders will soon be needed though.

SHEFFIELD.

(From our own Correspondent.)

Conditions in the Steel Trade.

There is little change to report in the general state of the steel trades of Sheffield and district. For the most part the works, whether heavy or light, are very short of orders, but there are a few bright exceptions, where a good deal of activity prevails. One of these is the great establishment of Vickers-Armstrongs, Ltd., where the Master Cutler and his guests, who paid a visit on the day after the Cutlers' Feast, saw the majority of departments distinctly busy, although some were slack. The demand for the cheaper classes of basic steel is still good, and prices are firm, with those of the softer qualities tending upwards. Makers of pig iron report that buying is showing some increase, and that consumers are displaying more interest in forward supplies. Acid steels, on the contrary, are in poor request. The association of makers of Siemens billets has withdrawn its control over prices, and this has been followed by a reduction, which, it is hoped, will stimulate buying. The minimum has been £10, but this has now been brought down by 10s. and 15s., and in special cases by as much as 20s. The shortage of orders on the acid steel side is largely due to the economical policy of the home railway companies. There has been little or nothing to do at the local rail mills for a considerable time, and all the axle and tire plants are working short time. It is generally believed that the railway companies must require new supplies before long, and also that the building of privately owned wagons must be resumed in the near future.

Features of Export Trade.

Sheffield's steel trade with the United States showed an improvement last quarter, the value of the exports being £63,600, which was an increase on the corresponding quarter of last year of nearly £10,000. Nearly half the total value was represented by wire and wire goods. Cutlery exports, on the other hand, at £12,600, showed a reduction. The bulk of the amount was for safety razor blanks, and there were items for pen and pocket cutlery, £1900; table and kitchen knives, £800; hunting and farriers' knives, £950; and tools, £900. Cutlery exports generally show an increase, and the figure for September was nearly £20,000 better than that for August. There was a decline in scissors, but gains in safety and ordinary razors. There was a marked advance in shipments to Australia and New Zealand. Imports of cutlery during the month amounted to £29,000, which was a slight drop on August. The total for the nine months is, however, higher than in either of the two preceding years.

Trade with Russia.

Russia, which before the war was one of Sheffield's best customers for saws, files, edge tools, and other goods, has been a poor market for several years. It was showing welcome signs of recovery until last year, when the raid on Arcos brought trade practically to a standstill. Now, happily, things are improving again. Substantial orders for saws and edge tools have been received lately, which will benefit several firms, whose factories will be kept busy for some time to come. The Russian buyers require very extended credit, and it is understood that, but for this, more business could be obtained. For certain classes of tools there is a better sale than has been the case lately. In the file and saw trades business is quiet as a rule, but the falling tendency of the demand seems to have been arrested.

Colliery Matters.

The coal-boring operations at Sandtoft, in the Isle of Axholme, North Lincolnshire, which have been in progress for some time, have been suspended. It is regarded as certain that the Barnsley seam, which is the principal objective of the borings, extends into the locality from the Doncaster coalfield, but it is understood that this has not yet been located, although three beds of coal have been tapped. A matter of interest alike to mining experts and to the electrical engineering industry was discussed by the Midland Institute of Mining Engineers at its meeting in Leeds last week. The desirability of producing an electrical instrument which would indicate the presence of fire-damp in a mine has been discussed for a long time, and the matter brought before the notice of the members was such an apparatus, called the Ringrose indicator. Mr. J. Crossland, of Leeds, who described it, said that he thought it was the first electrical device to give a definite indication when a certain percentage of fire-damp was present in the atmosphere. When that condition arose a red lamp was immediately lit, giving a very impressive indication of the presence of danger. It is generally agreed that the ordinary oil safety lamp is quite satisfactory for actual gas testing, and Mr. Crossland did not suggest that the new device would supersede it for that purpose. He considered, however, that it should be of the greatest use in connection with the use of coal cutters and other electrical appliances underground. The Coal Mines Act stipulated that electric current must be cut off from any appliance or machine, &c., if 1¼ per cent. or more of fire-damp is found in the atmosphere. Mr. Crossland's view as to the chief sphere of usefulness for the new indicator was supported by several members of the Institute.

New Works at Hull and Hope.

Industrial developments at Hull are proceeding apace. The latest instance is the decision of Cooper, Pass and Son, Ltd., of Bristol, to establish a solder works on the banks of the Humber to the west of the city. The firm is in negotiation for the acquisition of 120 acres of land, and it is expected that the arrangements will be completed shortly. The firm has large smelting works at Bristol, but it is stated that little lead will be smelted at Hull, where the chief business will be the making of solder. Houses for the employees are to be erected on the garden village plan. The firm was offered a site for works at Antwerp, but it is understood that it gave Hull the preference chiefly on patriotic grounds, in order that it might employ British labour. Another district in which industrial developments are in progress is Hope, in the Peak country, a few miles from Sheffield. As already reported, G. and T. Earle, Ltd., of Hull, are erecting very large cement works there. Now comes the news that Messrs. John Robinson and Co., contractors, of Rotherham, have acquired several acres of land, and commenced work on the erection of a factory for the manufacture of concrete window sills, mullions, flags and certain building materials. They also intend to open limestone quarries in the district.

Tower and Bridge.

Efforts are still being made to stabilise the unfortunate leaning water tower at Skegness. Mr. P. Griffith, the consulting engineer to the local Council, has now carried out one of a series of suggestions made by Sir Cyril Kirkpatrick, and has recommended that the sheet piling be completed as he originally advised. The Council has adopted the recommendation, which will involve an estimated cost of £1800. Mr. Griffith expresses confidence that with the full support and sympathy of the authority he can bring the tower into use. A new swing bridge, to carry the Bawtry and Selby main roads over the waterway of the Sheffield and South Yorkshire Navigation Company, at Thorne, is projected by the Highway Committee of the West Riding County Council. The Committee is in favour of erecting the bridge, at a cost not exceeding £7000, subject to a satisfactory contribution from central funds and to a contribution of £300 from the Navigation Company.

NORTH OF ENGLAND.

(From our own Correspondent.)

Cleveland Iron Trade.

Confidence in early business expansion is sustained in Cleveland iron trade circles, though much disappointment is felt at the slow rate of progress experienced up to the present. Makers have no longer to contend with keen continental competition, but while prices of overseas products are scarcely competitive, and many firms are reported to be so well sold that they are able to quote only for delivery well ahead, the state of affairs abroad is not diverting orders to this district to the extent that might be expected. The market has presented no new features this week. Consumers are inclined to order sparingly, and the absence of sufficient large forward contracts is a discouraging feature. Makers, however, are able to dispose of the limited quantities they have available after meeting the needs of their own consuming plants and foundries. At the same time, the greatly reduced number of furnaces in blast on the North-East Coast indicates how far trade has yet to expand before conditions can be deemed satisfactory. Prices are firm, No. 1 Cleveland foundry iron being 68s. 6d.; No. 3 G.M.B., 66s.; No. 4 foundry, 65s.; and No. 4 forge, 64s. 6d.

Hematite Pig Iron.

Business in the East Coast hematite pig iron trade is expanding on an encouraging scale. Producers, however, are not keen to enter into heavy contracts for forward delivery at the prices now ruling. At the same time, it is gratifying to see prices moving in the right direction as the result of improved home and export demand, which is rather in excess of production. The much depleted stocks are thus still being drawn upon, and the outlook in this branch is much brighter. Hope is entertained that the situation will be such as to justify an increase in output. Business is now being put through on the basis

of 70s. for mixed numbers, though it is reported that orders have been taken at a fraction in excess of that figure.

Ironmaking Materials.

Consumers of foreign ore are still holding off the market, but absence of buying is not weakening quotations. Merchants are as convinced as ever that supplies will become short, and they hold firmly to rates based on best Rubio at 22s. 6d. c.i.f. Tees. Imports against old contracts are on quite a good scale, and arrears of deliveries are being gradually overtaken. Good medium blast-furnace coke keeps in the neighbourhood of 17s. 9d. delivered at the works in this area, but business is on a very moderate scale.

Manufactured Iron and Steel.

The tone of the manufactured iron and steel market is fairly good with no change reported in prices. Some descriptions of finished iron are in slightly better demand, and semi-finished steel is selling more readily, consumers hitherto using foreign products now buying from manufacturers in this district at about figures named for continental material. Some substantial orders are reported for sheet bars. Business in finished steel is quiet, but some firms have a good deal of work on hand.

Ironstone Miners' Wages.

Under the selling price of Cleveland pig iron for the past quarter—63s. 1·19d. per ton—there was a trifling advance of 0·20 per cent. due to the Cleveland ironstone miners. In the April settlement the owners agreed to forego a small reduction of 1·90 per cent., and in July a reduction of 0·05 per cent. Having regard to all the circumstances, the miners agreed this week to their wages being unaltered for the ensuing three months. Thus the district percentage will remain at 55·50 per cent.

The Coal Trade.

The Northern coal trade wears a much brighter tone than has been the case for a long time past. Collieries have experienced a fairly brisk demand over the past few days, and they have got a little more for their product—which is a particularly encouraging feature. A considerable amount of new business has been booked, and it will be very helpful in sustaining the newer prices. All the coal is not being sold at the top figures quoted, but the minimum has been left behind in each grade of large, and that of itself is something to be thankful for, when one recalls how dull has been the position for the greater part of this year. There are a few pits in Northumberland which have not lost a day this year. It would be gratifying if that were a general experience in the county. Unfortunately, it is not; but the outlook is much brighter than it has been, and shipments should be on a large scale during the next few weeks. Both collieries and merchants are now holding firmly for 13s. 6d. to 14s. for best Northumberland steams for prompt and forward delivery. There are also signs of improvement in gas fuel, some of the collieries reporting good business over the next two or three weeks. Best Durham qualities are steadier at 14s. 9d., and secondary kinds are in much better demand at 13s. 3d. to 13s. 6d. A large quantity of very small Durham coal is being sold for a variety of purposes, and low temperature and pulverised fuel plants are finding more scope for the inferior kinds. The inquiry for coking coals is in growing volume, especially for the superior qualities, France and Belgium being good buyers. Supplies, however, are equal to all inquiries. The better grades of bunkers are also more active. The coke trade is not quite so active, but under considerable bookings and good tonnage supply on hand, the tone is firm for gas cokes at 20s. to 20s. 6d., and tending upwards. Patent oven cokes are in good supply, but steadily held at 18s. 3d. to 19s. Beehive and special cokes are firm at 24s. to 28s.

SCOTLAND.

(From our own Correspondent.)

Steel and Iron.

Market conditions show little change on the week, the general demand being still a shade quieter than it was a few weeks ago. The slow development of business is most disappointing to producers, especially in view of the greater facilities for production. In some quarters, however, a more hopeful feeling is maintained, owing to the continued firming tendency of continental commodities and protracted deliveries from abroad.

Steel.

Makers of heavy steel remain somewhat short of orders, and in this respect shipbuilding demands are most disappointing. So far as light sheets are concerned, the position is fairly satisfactory. Galvanised descriptions are doing a very good export turnover at firm prices. With the exception of lap-welded varieties, tube makers have good demands. Steel scrap is in moderate demand, with heavy steel on the basis of 65s. per ton.

Iron.

Business in bar iron is very restricted, and producers are poorly engaged. On the other hand, orders for re-rolled steel are quite numerous, the only drawback being the difficulty experienced by makers in securing an advance in price sufficient to cover the increase in the cost of raw materials. Re-rolled steel bars are quoted about £7 10s. home and £7 7s. 6d. per ton export.

Pig Iron.

The number of blast-furnaces in action in Scotland is round about twenty, compared with eighty in pre-war years. The present production, however, is ample to meet all demands. Prices are unchanged.

Exports and Imports.

Throughout the week 4200 tons of iron ore, 2000 tons of steel and iron, and 2000 tons of magnesite ore were discharged at Glasgow harbour. During the same period exports of steel and iron amounted to 9000 tons and pig iron to 581 tons.

Engineering: Unemployment Figures.

It has been reported that during the past month or so the unemployment figures in connection with the Amalgamated Engineering Union (Clyde district) showed a drop from 570 to 515 per week. The comparative figure for last year was 402. These figures refer to the number of local unemployed members of the Amalgamated Engineering Union signing the unemployment book during August and September of this year and the corresponding period in 1927.

Coal.

There has been no change of importance in the Scottish coal trade during the past week. Both home and export demands continue on disappointing lines, and collieries find great difficulty in securing the higher prices quoted for certain qualities. Lanarkshire ells are scarce and firm, but splints are quieter and barely steady. Lothians steams are quiet. The recent demand for third-class Fifeshire steams is maintained and supplies are difficult to arrange under ten days to a fortnight. Prompt business could be accepted for first-class Fifeshire steams. In all districts washed materials are somewhat irregular. Treble nuts are firm, but doubles show weakness and singles and pearls are not so firm. Aggregate shipments amounted to 262,759 tons, against 218,285 tons in the preceding week and 271,103 tons in the same week last year.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coal Trade Conditions.

The loading conditions at South Wales ports have been rather better during the past week, and judging from the inquiry for tonnage they should continue to be fairly active. The difficulty of merchants is still that there is a comparative shortage of suitable tonnage, with the consequence that outward rates of freight are firm and above what many charterers can really afford to pay when set against the rates which were allowed for when the business was tendered for. At the end of last week there were over thirty idle tipping appliances at the various docks, but as the result of week-end arrivals the docks presented a better appearance and the number of idle appliances was reduced to sixteen. Quite a number of orders are still held, and that fact, combined with the fact that the quantity of tonnage recently taken up shows some improvement, gives promise that shipments will at least be maintained. The returns of shipments for the week ended the 12th inst. were somewhat disappointing, as the total came to only 395,962 tons, which compared with over 440,000 tons for the preceding week. Hopes are entertained that the figures for the current week will come up to round about the 400,000 mark at least. The inquiry from abroad generally appears to be just a trifle better, but that is really no more than what is expected at this time of the year. Unfortunately the volume is insufficient definitely to improve prices, which are altogether too low to be remunerative and furthermore do not enable collieries to work regularly. Reference has already been made to inquiries over the next six and twelve months for supplies of Welsh coals for South America, and to the fact that the Algerian State Railways are in the market for over 200,000 tons of patent fuel and about 30,000 tons of washed smalls for delivery over 1929, and now comes the news that the Egyptian State Railways, which contracted last August for 140,000 metric tons of Welsh locomotive coals for delivery at Alexandria will be inviting prices for 280,000 tons of large coals to be delivered between February and August next. The adjudication will take place on January 17th next. As regards the French railways and their inquiries, it is reported that the Paris–Orleans line has bought a quantity of small coals from this district, but exactly what the amount is has not so far been disclosed.

Later.

The Paris–Orleans Railway is now reported to have contracted for the supply of 110,000 tons of Welsh large and small coals, to be delivered over 1929. The business has been placed with two Cardiff firms, one receiving an order for 70,000 large and 20,000 smalls, the other getting 20,000 tons of smalls.

September Coal Returns.

According to the Board of Trade returns the coal export trade for September for South Wales was not up to that for the previous month. The quantity worked out at 1,507,829 tons, as compared with 1,779,652 tons for August. Furthermore the average f.o.b. price worked out at 17s. 5d., as against 17s. 8d. Considering the fact that minimum coal prices underwent no change in September, the reduced f.o.b. value must be looked upon as the result of the shipment of a relatively larger quantity of the cheaper grades of coal, and also as due to the quantity of anthracite coals exported being somewhat reduced.

Colliery Changes Hands.

Reference was made last week to the reopening of the pits belonging to the International Coal Company, Ltd., Blaengarw. Since then the news has come that the property has now been purchased by the Glenavon Garw Collieries, Ltd., Port Talbot. The latter is a private undertaking and owns extensive colliery interests in the Afan and Glyncorrwg Valleys and at Gilfach Goch, while it also owns the Glengarw Colliery in the Blaengarw Valley, which adjoins the pits of the International Company.

Tin-plate Works Sold

The announcement is made that negotiations have practically reached completion for the acquisition of the Glanryhd Tin-plate Works, Pontardawe, by Messrs. Gilbertsons, of Pontardawe, the purchase price being, it is understood, in the region of £80,000. The Glanrhyd works were up to about twenty-eight years ago owned by Messrs. Gilbertsons, but they sold them to the Glanrhyde Company. They have six new mills and four old mills, but at the present time only the former are working. The re-purchase of the works is regarded as a good augury for the tin-plate industry, and it will provide a further outlet for Messrs. Gilbertsons' steel bars.

New Ships.

During the past two years round about fifty new ships have been ordered by South Wales shipowners. Many of them have since been built and launched, and now comes the news that Mr. B. Pardoe Thomas, of Newport, has placed with Lithgows, Ltd., of Glasgow, an order for five cargo steamers of tonnage varying from 6500 to 7200. These vessels will be delivered within the next eighteen months or two years, and will bring the fleet of Mr. Pardoe Thomas up to eight. This fresh order, at any rate, indicates the confidence of shipowners in the future.

South Wales Engineers.

Professor Geo. Knox, principal of the Treforest School of Mines, has been elected President of the South Wales Institute of Engineers for 1928–29.

Current Business.

There has been no appreciable change in the tone of the steam coal market during the past week. The fact that tonnage in dock has been rather more satisfactory means of, course, that shipments have been better, but there has been no shortage of supplies as standing stocks have been so heavy and continue to be more than ample for current needs. This applies more especially to large coals, but even in the case of sized descriptions buyers have experienced no difficulty in securing their requirements. Patent fuel and coke continue without any material alteration, and pitwood is about steady on the basis of 28s. 9d. to 29s. 3d.

CONTRACTS.

Worthington-Simpson, Ltd., of Queen's House, Kingsway, London and Newark-on-Trent, have received an order from Beyer, Peacock and Co., Ltd., for the supply of three 2 BZ locomotive feed-water heaters, to be fitted to three "Garratt" type locomotives for the Guayaquil and Quito Railway.

Howden Ljungstrom Preheaters (Land), Ltd., has received a third repeat order from the Shanghai Municipal Council for air preheaters for the Riverside Power Station in that city. The contract calls for four preheaters of the rotary regenerative type. Each is to be installed on a 100,000 lb. boiler. The same company has also received an order for the supply of a preheater to the Neasden Station of the Metropolitan Railway Company.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

Mr. John H. Sandiford, A.M.I.E.E., asks us to announce that he has joined the switchgear sales department of the English Electric Company, Ltd.

The Birmingham Railway Carriage and Wagon Company, Ltd., of Smethwick, asks us to announce that the address of its London office is now 10, Mayfair-place, London, W. 1, telephone No. 2130–2131.

Haslam and Stretton, Ltd., ask us to announce that their address has been changed from 11, Windsor-place, to 53, 54 and 55, Tredegar-street, Cardiff. Their telephone numbers and telegraphic address will remain as heretofore, namely, 2978 and Thor, Cardiff, respectively.

Mr. John Holloway, of Sentinel House, Southampton-row, W.C. 1, formerly general works manager with the North British Diesel Engine Works, Ltd., Glasgow, has now completed the lay-out and organisation of the new works at High Wycombe for Broom and Wade, Ltd., for which he was especially engaged by the firm's managing director.

Wild-Barfield Electric Furnaces, Ltd., asks us to announce that an arrangement has now been entered into between it and Alfred Herbert, Ltd., whereby the latter, in addition to representing Wild-Barfield Electric Furnaces in Scotland, India, Uruguay, Paraguay, and the Argentine, will in future also deal with those furnaces at all its British branches.

Sir David Milne-Watson and Mr. Robert Whyte Reid, M.I.M.E., have been appointed to be members of the Advisory Council to the Committee of the Privy Council for Scientific and Industrial Research, in the place of members who have retired on the completion of their terms of office. Sir James Hopwood Jeans has also been reappointed to be a member of the Advisory Council for a further period of one year.

LAUNCHES AND TRIAL TRIPS.

Sinnington Court, single-screw cargo steamer; built by Sir W. G. Armstrong, Whitworth and Co., Ltd., to the order of United British Steamship Company, Ltd.; dimensions, 420ft. by 56ft. 2in.; 9600 tons deadweight on a draught of 24ft. 11in. Engines, direct-acting surface condensing triple-expansion, pressure 180 lb. per square inch; trial trip, September 26th.

Marie Felling, twin-screw steam berthing tug; built by Earle's Shipbuilding and Engineering Company, Ltd., to the order of Crown Agents for the Colonies, for and on behalf of the High Commissioner for Transport, Kenya and Uganda; dimensions, 104ft. by 28ft. 6in. by 14ft. 3in. Engines, triple-expansion, 13½in. by 22in. by 37in. by 24in. stroke, pressure 180 lb. per square inch; trial trip, October 2nd.

Pass of Deny, single screw oil tanker; built by Blythswood Shipbuilding Company, Ltd., of Scotstoun, to the order of the Bulk Oil Steamship Company, Ltd., of London; dimensions, 200ft. by 30ft. 6in. by 14ft.; oil in bulk. Engines, triple-expansion, pressure 180 lb. per square inch; constructed by Aitchison, Blair, Ltd., of Clydebank; launch, October 2nd.

Port Hardy, twin-screw steamer; built by Swan, Hunter and Wigham Richardson, Ltd., to the order of Commonwealth and Dominion Line. Engines, Bauer-wach exhaust turbines; constructed by the builders; trial trip, recently.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. Coast—	
(1) Native	18/6 to 21/6
(1) Spanish	18/6 to 22/6
(1) N. African	18/6 to 22/6
N.E Coast—	
Native	18/– to 21/–
Foreign (c.i.f.)	22/6

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) Scotland—		
Hematite	3 14 0	—
No. 1 Foundry	3 15 0 to 3 16 0	—
No. 3 Foundry	3 11 0	—
N.E. Coast—		
Hematite Mixed Nos.	3 10 0	3 10 0
No. 1	3 11 0	3 11 0
Cleveland—		
No. 1	3 8 6	3 8 6
Silicious Iron	3 8 6	3 8 6
No. 3 G.M.B.	3 6 0	3 6 0
No. 4 Foundry	3 5 0	3 5 0
No. 4 Forge	3 4 6	3 4 6
Mottled	3 4 0	3 4 0
White	3 4 0	3 4 0
Midlands—		
(3) Staffs.—		
All-mine (Cold Blast)	—	—
North Staffs. Forge	—	—
,, ,, Foundry	3 2 6	—
(3) Northampton—		
Foundry No. 3	2 16 0 to 2 17 6	—
Forge	2 12 6	—
(3) Derbyshire—		
No. 3 Foundry	3 0 0 to 3 1 0	—
Forge	2 17 0	—
(3) Lincolnshire—		
No. 3 Foundry	3 0 0	—
No. 4 Forge	2 17 6	—
Basic	2 19 0	—
(4) N.W. Coast—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 0 0 (a) / 4 2 6 (b) / 4 5 6 (c)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
Scotland—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. Coast—		
Iron Rivets	11 5 0	—
Common Bars	10 5 0	—
Best Bars	10 15 0	—
Double Best Bars	11 5 0	—
Treble Best Bars	11 15 0	—
Lancs.—		
Crown Bars	10 0 0	—
Second Quality Bars	9 10 0	—
Hoops	13 0 0	—
S. Yorks.—		
Crown Bars	10 10 0	—
Best Bars	11 0 0	—
Hoops	12 10 0	—
Midlands—		
Crown Bars	9 2 6 to 10 0 0	—
Marked Bars (Staffs.)	12 0 0	—
Nut and Bolt Bars	8 12 6 to 8 17 6	—
Gas Tube Strip	10 15 0 to 10 17 6	—

STEEL. (d)

	(6) Home. £ s. d.	(7) Export £ s. d.
(5) Scotland—		
Boiler Plates	10 10 0	10 10 0
Ship Plates, ½in. and up	8 7 6	7 12 6
Sections	7 12 6	7 2 6
Steel Sheets, ¼in.	8 15 0	8 12 6
Sheets (Gal.Cor. 24 B.G)	13 10 0	13 10 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. Coast—		
Ship Plates	8 7 6	—
Angles	7 17 6	—
Boiler Plates	12 15 0	—
Joists	7 17 6	—
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5
Hard Billets	7 12 6	—
Soft Billets	6 15 0	—
N.W Coast—		
Barrow—		
Heavy Rails	8 5 0	—
Light Rails	8 10 0 to 8 15 0	—
Billets	7 5 0 to 10 0 0	—
Manchester—		
Bars (Round)	8 17 6	—
,, (Small Round)	7 17 6 to 8 2 6	—
Hoops (Baling)	10 0 0	9 15 0
,, (Soft Steel)	9 0 0	8 15 0
Plates	8 12 6 to 8 17 6	—
,, (Lancs. Boiler)	9 10 0 to 9 15 0	—
Sheffield—		
Siemens Acid Billets	9 5 0 to 9 10 0	—
Hard Basic	7 2 6 and 7 12 6	—
Intermediate Basic	7 0 0	—
Soft Basic	6 10 0	—
Hoops	9 0 0	—
Soft Wire Rods	7 5 0 to 7 10 0	—
Midlands		
Small Rolled Bars	7 15 0 to 8 0 0	—
Billets and Sheet Bars	6 5 0 to 6 7 6	—
Sheets (20 W.G.)	11 10 0 to 12 0 0	—
Galv. Sheets, f.o.b. L'pool	13 10 0 to 13 15 0	—
Angles	7 17 6	—
Joists	7 17 6	—
Tees	8 17 6	—
Bridge and Tank Plates	8 12 6	—
Boiler Plates	11 0 0	—

NON-FERROUS METALS.

Swansea—	
Tin-plates, I.C., 20 by 14	18/– to 18/3
Block Tin (cash)	220 0 0
,, (three months)	218 0 0
Copper (cash)	64 18 9
,, (three months)	65 6 3
Spanish Lead (cash)	22 3 9
,, (three months)	21 17 6
Spelter (cash)	24 0 0
,, (three months)	24 5 0
Manchester—	
Copper, Best Selected Ingots	69 10 0
,, Electrolytic	72 0 0
,, Strong Sheets	96 0 0
,, Tubes (Basis Price), lb.	0 1 1¼
Brass Tubes (Basis Price), lb.	0 1 0¼
,, Condenser, lb.	0 1 2¼
Lead, English	23 12 6
,, Foreign	22 0 0
Spelter	24 7 6
Aluminium (per ton)	£107

FERRO ALLOYS.

	Per Ton.	Per Unit.
Tungsten Metal Powder	1/8 per lb.	
Ferro Tungsten	1/3 per lb.	
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£21 10 0	7/6
,, ,, 6 p.c. to 8 p.c.	£20 10 0	7/–
,, ,, 8 p.c. to 10 p.c.	£20 0 0	6/–
,, ,, Specially refined		
,, ,, Max. 2 p.c. carbon	£33 0 0	12/–
,, ,, ,, 1 p.c. carbon	£37 0 0	15/–
,, ,, ,, 0·70 p.c. carbon	£41 0 0	17/–
,, ,, ,, carbon free	1/– per lb.	
Metallic Chromium	2/7 per lb.	
Ferro Manganese (per ton)	£13 15 0 for home £13 10 0 for export	
,, Silicon, 45 p.c. to 50 p.c.	£12 0 0 scale 5/– per unit	
,, ,, 75 p.c.	£19 0 0 scale 6/– per unit	
,, Vanadium	14/– per lb.	
,, Molybdenum	4/3 per lb.	
,, Titanium (carbon free)	1/2 per lb.	
Nickel (per ton)	£170 to £175	
Ferro-Cobalt	9/– per lb.	

FUELS.

SCOTLAND.

(Prices not stable.)

	Export.
Lanarkshire—	
(f.o.b. Glasgow)—Steam	13/9
,, ,, Ell	16/–
,, ,, Splint	15/9 to 16/
,, ,, Trebles	13/6 to 14/–
,, ,, Doubles	13/6
,, ,, Singles	12/9
Ayrshire—	
(f.o.b. Ports)—Steam	13/6
,, ,, Jewel	15/6
,, ,, Trebles	13/9
Fifeshire—	
f.o.b. Methil or Burntisland—Steam	11/9 to 12/9
Screened Navigation	16/–
Trebles	14/9 to 16/–
Doubles	13/–
Singles	12/9
Lothians—	
(f.o.b. Leith)—Best Steam	12/3 to 12/6
Secondary Steam	11/9
Trebles	15/–
Doubles	13/6
Singles	12/9

ENGLAND.

(8) N.W. Coast—	
Steams	25/6
Household	38/6 to 51/–
Coke	22/6 to 23/6
Northumberland—	
Best Steams	13/6 to 13/9
Second Steams	12/6 to 12/9
Steam Smalls	9/– to 9/6
Unscreened	11/9 to 12/–
Household	21/– to 27/–
Durham—	
Best Gas	14/6 to 14/9
Second	13/– to 13/3
Household	21/– to 27/–
Foundry Coke	18/6 to 19/6
Sheffield— Inland.	
Best Hand-picked Branch	28/– to 27/6
Derbyshire Best Bright House	23/– to 24/6
Best House Coal	20/6 to 21/6
Screened House Coal	17/– to 18/–
,, ,, Nuts	16/– to 18/–
Yorkshire Hards	14/6 to 16/–
Derbyshire Hards	14/6 to 16/–
Rough Slacks	8/6 to 9/6
Nutty Slacks	4/6 to 6/–
Smalls	3/– to 4/6
Blast-furnace Coke (Inland)	13/6 at ovens
Furnace and Foundry Coke (Export), f.o.b.	19/– to 19/6

(9) SOUTH WALES.

Cardiff— Steam Coals :	
Best Smokeless Large	19/3 to 19/6
Second Smokeless Large	18/– to 19/–
Best Dry Large	17/9 to 18/6
Ordinary Dry Large	17/ to 17/3
Best Black Vein Large	17/6 to 17/9
Western Valley Large	17/– to 17/3
Best Eastern Valley Large	16/6 to 17/–
Ordinary Eastern Valley Large	16/3 to 16/6
Best Steam Smalls	12/6 to 13/–
Ordinary Smalls	10/6 to 12/–
Washed Nuts	17/6 to 18/6
No. 3 Rhondda Large	19/6 to 20/
,, ,, Smalls	14/– to 14/6
No. 2 ,, Large	16/– to 16/6
,, ,, Through	14/6 to 15/6
,, ,, Smalls	11/– to 12/–
Foundry Coke (export)	27/– to 37/–
Furnace Coke (export)	19/– to 21/–
Patent Fuel	20/– to 21/6
Pitwood (ex ship)	28/3 to 28/9
Swansea— Anthracite Coals :	
Best Big Vein Large	34/– to 35/6
Seconds	24/6 to 27/6
Red Vein	21/– to 27/–
Machine-made Cobbles	40/– to 43/6
Nuts	35/– to 43/6
Beans	23/6 to 25/–
Peas	18/– to 18/6
Breaker Duff	8/– to 8/6
Rubbly Culm	10/9 to 11/3
Steam Coals :	
Large	17/6 to 18/6
Seconds	16/– to 17/–
Smalls	12/– to 12/6
Cargo Through	15/– to 16/–

(1) Delivered. (2) Net Makers' Works. (3) f.o.t. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire and Ayrshire.

(6) Home Prices—All delivered Glasgow Station. Boiler Plates 10/– extra delivered England. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (a) Deliverd Glasgow. (b) Delivered Sheffield, (c) Delivered Birmingham. (d) Rebate 12/6 joists and 10/– all other materials if home consumers confine purchases solely to British products.

French Engineering Notes.

(From our own Correspondent in Paris.)

Engineering and Prices.

THE future activity of the constructive engineering trades depends largely upon the course of steel prices, and it is feared that a further notable advance may arrest the programmes which are being put in hand for building and public works. Those programmes are of considerable importance, and their execution is only limited by the money available, but the Government estimates now being prepared provide for such a large increase of credits for this purpose that there appears likely to be a much greater activity in engineering work during the next year. The Loucheur scheme for house building should alone absorb an enormous quantity of iron and steel. Nevertheless, the outlook in this respect is not altogether satisfactory, and the steel makers' association is continuing an inquiry into the competition of ferro-concrete, particularly in order to ascertain to what extent iron and steel have been superseded by concrete in the construction of buildings, bridges and other works. It is obvious that if the prices of steel continue to rise there will be no check upon the extension of concrete, and it will become exceedingly difficult later on to recover lost ground. Judging by the way in which steel prices are hardening, it is quite probable that producers will eventually raise quotations, and they appear to have some justification for doing so, since mill and forge owners are doing just as much as they can with the labour available, and it is affirmed that, with the present supply of labour, it has become very difficult to increase production. In the department of the Nord, especially, it has only been possible to carry on with the aid of hands imported from Belgium and Poland, and in some places the proportion of Poles is particularly high; but, while encouraging this immigration, the French Government finds that there are difficulties in the way, and it is by no means sure that iron and steel producers in the Nord can rely upon a considerable addition to the present supply of labour. All this influences the future of the iron, steel, and engineering trades, for, while present prices favour consumers, any notable advance due to the demand overtaking supply would place manufacturers in a serious position. As was the case a few years ago, many public works schemes would have to be suspended through the estimated costs being exceeded by the high cost of material. On the other hand, iron and steel producers are finding that competition from Great Britain is becoming an increasingly dangerous factor in foreign markets, and they have every inducement to obtain higher prices at home in order to enable them to make more tempting offers abroad. They have to choose between developing either the home or the export trade.

Algerian Public Works.

The programmes of public works to be carried out in Algeria are prepared by an assembly of representatives of all the public bodies, and in arranging the programme to be started upon in the coming year the assembly aims at utilising material supplied by Germany on account of reparations to a quite considerable extent. If Germany were required to provide everything the Colonies need she would probably find herself greatly embarrassed. The Algerian programme covers all kinds of public works, including the construction of new railways between Bizot and Djidjalli, and between Nemours and Marnia, and the relaying of existing lines; the equipment of Algiers, Oran, Bône and Philippeville with elevating machinery and dredgers; the construction of barrages and the laying down of hydro-electric installations, particularly for the electrification of the Bone–Oued-Keverit Railway; the laying of telegraph and telephone cables, including one to Marseilles, at a cost of 500 million francs; rural electrification and electric ploughing; and a considerable amount of municipal work to be carried out at Algiers and Oran. The estimated cost of these works is something like 1000 million francs.

Submarine Loss.

The disappearance of the submarine "Undine" with forty-three officers and men on its voyage from Cherbourg to Bizerta, and the collision of a Greek ship during the night with something that immediately sank off the coast of Spain, have left no doubt as to the fate of the missing vessel. After inspection of the damage sustained by the Greek ship, which is now at Rotterdam, the first surmise was that the submarine passed across the bows of the steamer, but that conclusion will not be accepted unless confirmed by a more complete investigation. The "Undine" was one of twelve submarines displacing 600 tons at the surface and fitted with 1200 horse-power engines. It was built in 1925. It appears that this submarine was not regarded as a particularly successful type. It took quite a long time to pass through the trials. One feature of its design is that, at the surface, it had particularly high yacht shaped bows and was almost awash astern.

Signal Control.

It is usually difficult to arrive at any definite conclusion as to the cause of railway accidents, for, while the indicators on locomotives show whether the fault lies with the driver or not, the state of the permanent way after an accident makes it less easy to determine the responsibility of the signalman. An engineer of the State Railways, Monsieur Bienvenu, has therefore devised a recording indicator which is being experimented with at the Gare Montparnasse. It records all the movements of the levers on a band graduated in millimetres and moving at the rate of one millimetre a minute. Each lever is associated with a pen which inscribes horizontal and vertical lines according to its movements, so that, by marking the band with the times at which it is inserted in the recorder and removed, it is easy to read the position of any particular lever at a given moment. Thus the position of a lever is known at the time of an accident, even if all other evidence were destroyed by the tearing up of the permanent way, and the device has the further advantage of providing data concerning the work entailed by the traffic during the day.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

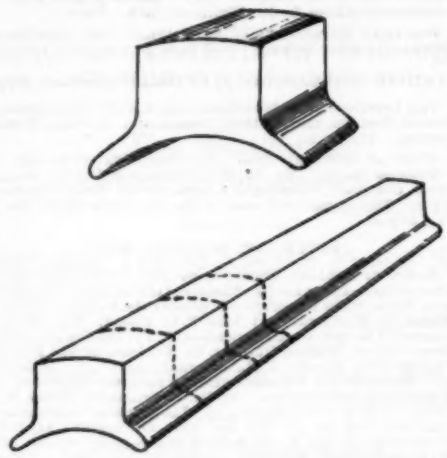
The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

DYNAMOS AND MOTORS.

292,135. November 21st, 1927.—IMPROVEMENTS IN OR RELATING TO THE MANUFACTURE OF POLES FOR THE MAGNETS OF ELECTRIC MOTORS OR THE LIKE, Lionel Holland, of 1, British Indian-street, Calcutta.

According to this invention, the pole parts with pole shoes

Nº292,135



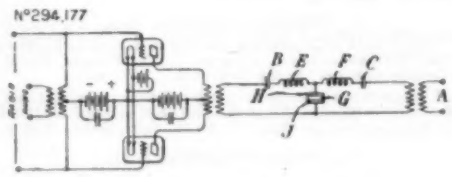
of electrical machines are rolled solid out of suitable material, such as soft magnetic iron, in the form of a bar, as shown in the lower illustration. After the material has been rolled the bar is cut into sections to form complete poles as shown in the upper illustration.—*September 6th*, 1928.

TELEGRAPHS AND TELEPHONES.

294,177. July 17th, 1928.—IMPROVEMENTS IN ELECTRIC FILTER CIRCUITS, *The British Thomson-Houston Company, Ltd., of Crown House, Aldwych, London, W.C.* 2.

The system illustrated comprises a pair of balanced modulation devices connected between an audio-frequency input circuit and an output circuit A through a band pass filter which comprises series-connected capacities B and C, inductances E and F, and a shunt-connected piezo element including a crystal G and electrodes H and J. The free vibration of the crystal is deter-

Nº294,177



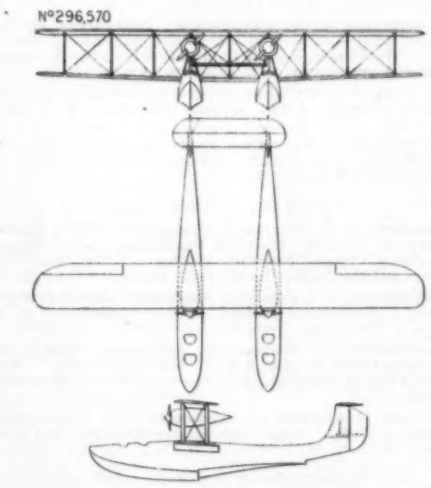
mined for the most part by its mechanical dimensions. When subjected to an electrostatic field of a frequency corresponding to its free vibration period the crystal exhibits the properties of a resonant circuit having extremely low loss. With the crystal connected as illustrated, currents of frequencies which correspond substantially to its free vibration period are excluded from the output circuit A and a sharp line of demarcation is readily maintained between the transmitted and excluded frequencies.—*September 6th*, 1928.

AERONAUTICS.

296,570. September 27th, 1927.—FLYING BOATS, S. E. Saunders, White House, Columbine Yard, East Cowes, Isle of Wight.

This invention virtually amounts to the adoption of the

Nº296,570



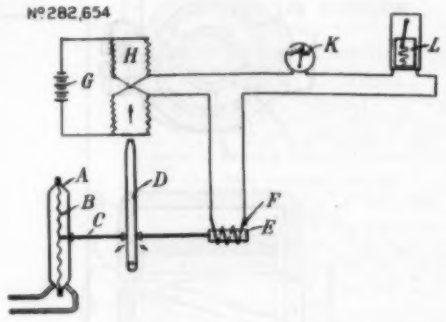
catamaran principle to flying boats in order to improve stability during the process of "taxying" across the water previous to taking flight. It is suggested that, for this purpose, the machine may have two finer and deeper hulls than is usual with a single boat, but the actual proportions are not indicated. The illustrations need no comment.—*September 6th*, 1928.

MEASURING AND TESTING INSTRUMENTS.

282,654. December 10th, 1927.—METHOD OF AND APPARATUS FOR THE CONVERSION OF MECHANICAL MEASURING VALUES INTO THE CORRESPONDING ELECTRICAL MEASURING VALUES, Askania-werke A.G. vormals Centralwerkstatt Dessau und Carl Bamberg-Friedenau, of 87–88, Kaiser Allee, Berlin-Friedenau, Germany.

The casing A is divided into two parts by a diaphragm B and one compartment of the casing is connected to the pressure to be measured whilst the other is exposed to the atmosphere. When a difference of pressure has to be measured the two pressures are transmitted to the two compartments, so that the diaphragm assumes a position in accordance with the difference.

Nº282,654



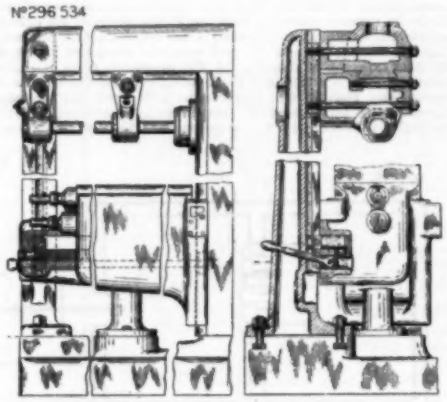
To the diaphragm B a hinged rod C is attached and the other end is joined to a jet pipe D traversed by compressed air or liquid under pressure. The pipe D is also connected to an iron core E within a coil F. The coil is included in a circuit connected to a battery G and in which there is a Wheatstone bridge H, an ammeter K, or a recording instrument L. If the pressure in the chamber A changes, the pipe D is deflected and the resistances of the Wheatstone bridge are cooled by unequal amounts. This causes the galvanometer to give a reading, and as a result of the current flowing through the coil F the core E brings the diaphragm back again. The force produced by the current will balance the pressure, and by measuring the current it is possible to determine the pressure.—*September 6th*, 1928.

MACHINE TOOLS AND SHOP APPLIANCES.

296,534. August 6th, 1927.—MILLING MACHINE SUPPORTS, Sir A. Herbert, Dunley Manor, near Whitchurch, Hants; and P. V. Vernon, Keresley Manor, Keresley, near Coventry.

This is truly an "omnibus" specification and concerns the use of a steady rest for the outer ends of the upper arm, the spindle, and the knee bracket of a milling machine. It is even

Nº296,534



suggested that two steadies may be employed, one on either side of the centre line of the spindle. The general arrangement of the scheme is indicated in the drawings, from which it will be seen that any of the items requiring support may be clamped individually to the stay and that the stay may be removed *in toto*.—*September 6th*, 1928.

MISCELLANEOUS.

296,919. October 22nd, 1927.—CRACKING AND FRACTIONATION OF HYDROCARBON MIXTURES, *C. Arnold*, 11, *Southampton-Buildings, London, W.C.* 2.

This specification covers a process for the pyrolysis of petroleum hydrocarbons in which the raw material is heated in an

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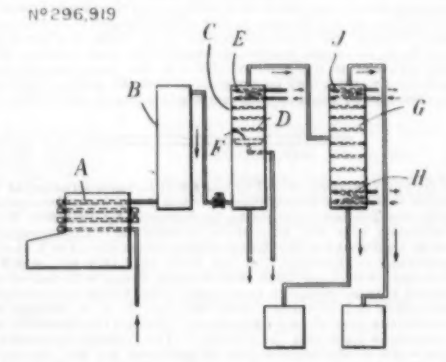
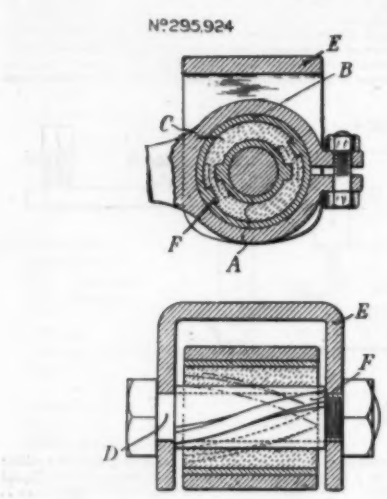


exteriorly heated coil A, and passes on to a chamber B, which is lagged to prevent the loss of heat. The gases coming from this chamber are introduced into the bottom of the fractionating tower C, which is equipped with rectifying plates D, a cooling coil E, and a collecting pan F. The vapour coming from the top of

this tower is led to the mid-portion of a second fractionating tower G, which has a heating coil H at the bottom, and a cooling coil J at the top. The several fractions are drawn off from the towers as indicated.—*September 13th*, 1928.

295,924. May 3rd, 1928.—Improvements in Flexible or Elastic Bearings or Joints, Arthur Sam Cheston, of 1 and 2, Mary Ann-street, St. Paul's-square, Birmingham; and William Chinn, of 94 Longford-road, Chorlton-cum-Hardy, Manchester.

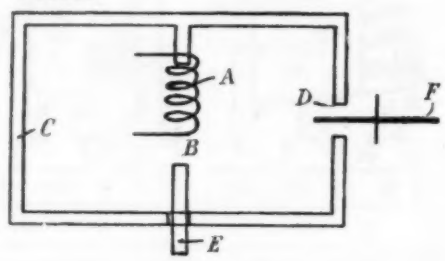
The elastic bearing described in this specification consists of an inner metal sleeve A and an outer sleeve or housing B with



an india rubber bush C between them. In the form shown the invention is applicable to a shock absorber for a motor car. The sleeve A is mounted on a bolt D carried by a U-shaped bracket E which is secured to the chassis of the vehicle. The outer sleeve or housing B is enclosed and clamped within a split ring, carried by another oscillating part. The inner sleeve A is provided on its outer periphery with spiral keys or ribs F.—*August 28th*, 1928.

296,324. May 26th, 1927.—Improvements in or relating to Electromagnetic Relays, Igranic Electric Company, Ltd., of 147, Queen Victoria-street, London, E.C. 4; and Johann Hermann Abbink-Spaink, of 25, Conduit-road, Bedford.

It is well known that when the armature of an electromagnetic relay is travelling from the open to the closed position its speed increases as it approaches this latter position. Various proposals have been made with a view to keeping this speed constant and, in particular, brakes of the kind commonly known as eddy current brakes have been used. Difficulty has, however, arisen owing to the fact that the variation in braking effort of the eddy current brake in response to variation of the speed of rotation of its disc is governed by a law different from that which controls the variation in the pull upon the armature in response to the variation in distance of the armature from the closed position. The result is that the braking effort increases at a rate lower than that of the increase in pull upon the armature. According to this invention, this difficulty is overcome. When the coil A is energised a flux is generated which crosses the main



gap B and divides into two paths, one of which passes around the circuit comprising the main gap B and unbroken arm C and the other around the circuit comprising the main gap B and the braking gap D. Under the influence of the flux crossing the main gap B the armature E begins its movement towards the closed position, thereby causing the disc F to rotate in the braking gap D and set up the braking action. The nearer the armature E approaches its closed position the more the tractive effort increases, and the faster would be its speed of travel, if it were unrestricted, and the greater will the flux become. As, however, the circuit comprising the unbroken arm C is initially at high flux density, the greater part of the additional flux will be driven around the circuit comprising the braking gap D. Thus the braking effort is increased, independently of the speed of rotation of the disc, by the increase in flux across the gap D in which the disc operates. As this flux increases as the distance of the armature from its closed position decreases, the total braking effort will increase as the tractive effort of the armature increases and the structure may be designed so that the speed of travel of the armature remain nearly constant.—*August 27th*, 1928

Royal Institution.—The courses of lectures arranged at the Royal Institution during November and December will commence with the Tyndall Lectures to be delivered by Professor H. L. Callendar, who will give three lectures on "Co-aggregation *versus* Continuity in the Change of State from Liquid to Vapour," beginning on Tuesday, October 30th, at 5.15 p.m.; while on Tuesday, November 20th, Sir William Bragg will deliver the first of four lectures on "Diamonds." On Saturday afternoon, November 3rd, at three o'clock, the Rev. T. E. R. Phillips will deliver the first of two lectures on "Recent Observations and Discoveries respecting the Planets." The Juvenile Lectures this year—the 103rd course—will be delivered by Mr. Alexander Wood, and will be on "Sound Waves and their Uses." (1) "Waves," December 27th; (2) "Signalling in Air and Water," December 29th; (3) "Notes and Noises," January 1st; (4) "How Sounds are Analysed," January 3rd; (5) "The Ear and What it Does," January 5th; (6) "How Sounds are Recorded and Reproduced," January 8th.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

Institution of Mechanical Engineers.—Storey's-gate, Westminster, S.W. 1. General meeting. Presidential address by Mr. Richard W. Allen. 6 p.m.

Junior Institution of Engineers.—39, Victoria-street, London, S.W. 1. "Technical Advertising," by Mr. R. H. Sharp. 7.30 p.m.

North-East Coast Institution of Engineers and Shipbuilders.—In the Lecture Theatre of the Literary and Philosophical Society, Newcastle-on-Tyne. Annual general meeting. Presidential address, by Mr. Maurice S. Gibb. 6 p.m.

Sheffield Metallurgical Association.—198, West-street, Sheffield. Ladies' evening. 7.15 to 10.30 p.m.

FRIDAY AND SATURDAY, OCTOBER 19TH AND 20TH.

The Institution of Municipal and County Engineers.—Council Chamber, the Guildhall, Portsmouth. Southern District meeting. 11.30 a.m.

West of Scotland Iron and Steel Institute.—In the "Societies' Room," No. 24, Royal Technical College, George-street, Glasgow. Presidential address, by Mr. Robert Crichton. 7 p.m. The Council will meet in the Committee Room No. 26 at 6.30 p.m.

SATURDAY, OCTOBER 20TH.

North of England Institute of Mining and Mechanical Engineers.—In the Lecture Theatre of the Institute, Newcastle-upon-Tyne. The President will present the Institute prizes to Messrs. L. H. Forster and John F. C. Friend. The following papers will be open for discussion:—(*a*) "The Sinking of Londonderry Colliery, Seaham Harbour, Co. Durham, by the Freezing Process," by Messrs. J. L. Henrard and J. T. Whetton; (*b*) "Extracts and Recommendations from the Report of the Water Dangers Committee," by Mr. T. Greenland Davies, H.M. Divisional Inspector of Mines; (*c*) "The Physical Constitution of Coal and Coal Seams," by Dr. John G. Kellett; (*d*) "The Distribution of Ash in Bituminous Coal Seams," by Dr. John G. Kellett. The following papers will be read:—"Notes on the Conversion of Main Pumping from Steam to Electricity, with Special Reference to the Plant Installed at Messrs. The Stella Coal Company's Clara Vale Pit," by Mr. L. H. Forster, Assoc. I.M.E.; "Tru-Lay Wire Ropes and Tru-Loc Fittings," by Mr. A. T. Adam. 2.30 p.m.

MONDAY, OCTOBER 22ND.

Illuminating Engineering Society.—Assembly Rooms, at the Chamber of Commerce, New-street, Birmingham. "An Investigation of Electric Lighting in the Engineering Industry," by Mr. J. L. H. Cooper. 7 p.m.

Institution of Electrical Engineers: North-Eastern Centre.—Armstrong College, Newcastle-on-Tyne. Opening address, by Mr. C. W. Salt. 7 p.m.

Institution of Mechanical Engineers.—Storey's-gate, St. James's Park, London, S.W. 1. Graduates' Section. "Compressed Air for Mining and Industrial Purposes," by Mr. H. R. Steward. 6.30 p.m.

TUESDAY, OCTOBER 23RD.

Institution of Engineers and Shipbuilders in Scotland.—39, Elmbank-crescent, Glasgow. "The Natural Period of Vibration of Ships," by Mr. A. P. Cole. 7.30 p.m.

University of London.—King's College, Strand, London, W.C.2. "A Hundred Years of Naval Engineering," Lecture II., by Engineer-Captain Edgar C. Smith, R.N., Retd. 5.30 p.m.

WEDNESDAY, OCTOBER 24TH.

Institution of Production Engineers.—At the Society of Motor Manufacturers and Traders, Ltd., 83, Pall Mall, London, S.W. 1. "Time Study and Shop Demonstration Methods," by Mr. B. C. Jenkins. 7.30 p.m.

Northampton Engineering College Engineering Society.—St. John-street, E.C. 1. "Modern High-tension Switchgear," by Mr. C. S. Mills. 5.30 p.m.

WEDNESDAY TO FRIDAY, OCTOBER 24TH TO 26TH.

Institution of Mining Engineers.—Annual general meeting, London. For programme see page 401.

THURSDAY, OCTOBER 25TH.

Chadwick Public Lecture.—At the Royal Institute of British Architects, 9, Conduit-street, W. 1. Lecture, "Public Health Buildings and Recent Improvements in Town Development in Sweden," by Mr. Torben Grut. 5 p.m.

Institution of Civil Engineers: Birmingham District Association.—Chamber of Commerce, New-street, Birmingham. "Reinforced Concrete from an Economic and Commercial Point of View," by Mr. A. E. Douglass. 6 p.m.

Institution of Civil Engineers: Yorkshire Association.—Hotel Metropole, Leeds. Address by Professor W. T. David. 7.30 p.m.

Institution of Electrical Engineers.—Savoy-place, Victoria Embankment, W.C. 2. Opening address, by Lieut.-Col. K. Edgcumbe, T.D. 6 p.m.

FRIDAY, OCTOBER 26TH.

Institution of Electrical Engineers: North-Eastern Students' Section.—Electrical Engineering Lecture Theatre, Armstrong College, Newcastle-on-Tyne. "Post Office Telephones and the Public," by Mr. L. B. Harmer. 7.15 p.m.

Institution of Locomotive Engineers.—Hotel Metropole, Leeds. "Glimpses of Colonial Railway Conditions," by Mr. E. De H. Rowntree. 7 p.m.

Institution of Mechanical Engineers.—Storey's-gate, St. James's Park, London, S.W. 1. Informal meeting. "Mechanical Plant in Gasworks," introduced by Mr. R. C. Macdonald. 7 p.m.

Junior Institution of Engineers.—39, Victoria-street, London, S.W. 1. "Legal Protection for Originality and Inventions," by Mr. G. W. Tookey. 7.30 p.m.

SATURDAY, OCTOBER 27TH.

Institute of British Foundrymen: Lancashire Branch.—The College of Technology, Sackville-street, Manchester. Presidential address, "The Prospects and Opportunities of Young Foundrymen," by Mr. T. Makemson. 7 p.m.

Institution of Municipal and County Engineers.—Town Hall, Pontefract. Yorkshire District Meeting. 1.45 p.m.

MONDAY, OCTOBER 29TH.

Bradford Engineering Society.—Technical College, Bradford. "Time Recording and Costing," by Mr. A. H. Gledhill. 7.30 p.m.

Illuminating Engineering Society.—Electric Lighting Service Bureau, 4, Fountain-street, Manchester. "An Investigation of Electric Lighting in the Engineering Industry," by Mr. J. L. H. Cooper. 7 p.m.

Institution of Electrical Engineers.—Victoria Embankment, London, W.C. 2. Informal meeting. Discussion on "Our Profession from a Manufacturer's Point of View," to be opened by the President, Lieut.-Col. K. Edgcumbe, T.D. 7 p.m.

TUESDAY, OCTOBER 30TH.

University of London.—King's College, Strand, London, W.C. 2. "A Hundred Years of Naval Engineering," Lecture III. by Engineer-Captain Edgar C. Smith, R.N., Retd. 5.30 p.m.

WEDNESDAY, OCTOBER 31ST.

Illuminating Engineering Society.—North-East Coast Lighting Service Bureau, Dial House, Northumberland-street, Newcastle-on-Tyne. "An Investigation of Electric Lighting in the Engineering Industry," by Mr. J. L. H. Cooper. 7.15 p.m.

Institution of Municipal and County Engineers.—Town Hall, Accrington. Informal discussion on "Bricks and Brick-making," at 11.30 a.m. Visit to the Accrington Brick and Tile Company's Works. 2.15 p.m.

THURSDAY, NOVEMBER 1ST.

Illuminating Engineering Society.—Central Halls, 25, Bath-street, Glasgow. "An Investigation of Electric Lighting in the Engineering Industry," by Mr. J. L. H. Cooper. 7.30 p.m.

Institution of Mechanical Engineers: Yorkshire Branch.—At the University, Leeds. "Gaseous Explosions," by Mr. B. H. Thorp. 7.30 p.m.

Royal Aeronautical Society.—At the House of the Royal Society of Arts, John-street, Adelphi, London, W.C. 2. "The Testing of Adhesives for Timber," by Mr. W. D. Douglas and Miss C. B. Pettifor. 7.45 p.m.

FRIDAY, NOVEMBER 2ND.

Institution of Engineering Inspection.—In the House of the Royal Society of Arts, John-street, Adelphi, London, W.C. 2. "Die Casting," by Mr. A. H. Mundey. 5 p.m.

Institution of Municipal and County Engineers.—Hams Hall Power Station, Birmingham. Inspection of works in progress. Leave the Council House, Birmingham, 2 p.m.

Junior Institution of Engineers.—39, Victoria-street, London, S.W. 1. Film, "The Babcock Boiler." 7.30 p.m.

University of London.—University College, Gower-street, London, W.C. 1. "Smoke Pollution of the Air and Public Health," Lecture I., by Dr. John Owens. 5.30 p.m.

TUESDAY, NOVEMBER 6TH.

The Illuminating Engineering Society.—32, Victoria-street, London, S.W. 1. At the Lighting Service Bureau, 15, Savoy-street, Strand, W.C. 2. A brief report on progress during the vacation will be presented by the Hon. Secretary. Mr. C. C. Paterson will deliver an address dealing with "The International Illumination Congress in the United States." Reports by the Committees on Progress in Gas and Electric Lighting will be presented. Various exhibits—new lighting fittings, illuminated signs, photometers—illustrating progress in illuminating engineering will be demonstrated. 6.30 p.m.

THURSDAY, NOVEMBER 8TH.

Institution of Municipal and County Engineers.—Deptford Town Hall. "Granite Setts in and Around London: Some Factors Affecting their Wear: Description of Micro-structure of Granite Setts," illustrated by lantern slides, by Mr. B. H. Knight. Exhibition of rock cutting methods by Mr. W. J. Pickering. 6 p.m.

Royal Aeronautical Society.—At the House of the Royal Society of Arts, John-street, Adelphi, London, W.C. 2. "The Machinery Installation of 'R 101,'" by Wing-Commander T. R. Cave-Browne-Cave, C.B.E. 7.45 p.m.

FRIDAY, NOVEMBER 9TH.

Junior Institution of Engineers.—39, Victoria-street, London, S.W. 1. Annual general meeting. 7.30 p.m.

Keighley Association of Engineers.—Room 14, Temperance Institute, Keighley. "Precise Length and Angular Measurement," by Mr. C. H. Carter. 7.30 p.m.

The Faraday Society.—In the Lecture Theatre of the Royal Institution, Albemarle-street, London, W. 1. The first Spiers Memorial Lecture, "Some Debatable Problems in Physics," by Sir Oliver Lodge. 3.30 p.m.

MONDAY, NOVEMBER 12TH.

Institution of Electrical Engineers.—Victoria Embankment, London, W.C. 2. Informal meeting. Discussion on "Engineering Requirements of a Modern Office Building," opened by Mr. J. Coxon. 7 p.m.

TUESDAY, NOVEMBER 13TH.

University of London.—University College, Gower-street London, W.C. 1. "High-tension Transmission of Power," Lecture I., by Mr. Percy Dunsheath. 6.30 p.m.

WEDNESDAY, NOVEMBER 14TH.

Belfast Association of Engineers.—Central Hall, Municipal College of Technology, Belfast. "Low-pressure Hot Water Heating," by Mr. A. W. Brown. 7.30 p.m.

FRIDAY, NOVEMBER 16TH.

Institution of Engineers and Shipbuilders in Scotland.—Grosvenor Restaurant, Gordon-street, Glasgow. The "James Watt" Lecture.

Institution of Locomotive Engineers: North-Eastern Centre.—Hotel Metropole, Leeds. "The Locomotive Smoke-box," by Mr. E. Windle. 7 p.m.

TUESDAY, NOVEMBER 27TH.

Institution of Engineering Inspection.—Hyde Park Hotel, London. Annual reception and dance. 8.30 p.m.

THURSDAY, NOVEMBER 29TH.

Institution of Civil Engineers: Yorkshire Association.—Hotel Metropole, Leeds. "Some Experiments in Measuring the Strain in the Reinforcing Bars of Concrete Steel Beams," by Mr. J. Gilchrist. 7.30 p.m.